RBI®

LCD OMINATOR SERIES

Finned copper tube Gas boilers (LB) & Water heaters (LW)

Boiler manual

Installation and operation instructions

WARNING This manual is intended only for use by a qualified heating installer/technician. Read and follow this manual, all supplements and related instructional information provided with the boiler. Install, start and service the boiler only in the sequence and methods given in these instructions. Failure to do so can result in severe personal injury, death or substantial property damage.

WARNING **Do not use the boiler during construction.** Construction dust and particulate, particularly drywall dust, will cause contamination of the burner, resulting in possible severe personal injury, death or substantial property damage. The boiler can only be operated with a dust-free air supply. Follow the instruction manual procedures to duct air to the boiler air intake. If the boiler has been contaminated by operation with contaminated air, follow the instruction manual guidelines to clean, repair or replace the boiler if necessary.

CAUTION Affix these instructions near to the boiler. Instruct the building owner to retain the instructions for future use by a qualified service technician, and to follow all guidelines in the User's Information Manual.

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WARNING If the information in this manual is not followed exactly, a fire or explosion may result causing property, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance

WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Do not touch any electrical switch. Do not use any phone in your building.**
- **Immediately call your gas supplier from a phone outside the building. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WARNING Assurez-vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommoge matériel, toute blessure ou la mort

Ne pas entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- **Ne pas tenter d'allumer d'appareil.**
- **Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.**
- **Appelez immédiatement votre fournisseur de gas depuis un voisin. Suivez les intructions du fournisseur.**
- **Si vous ne purvez rejoindre le fournisseur, appelez le service des incendies.**

L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.

WARNING Failure to properly vent this unit can cause excessive amounts of carbon monoxide resulting in severe personal injury or death!

DESIGNED AND TESTED ACCORDING TO A.S.M.E. BOILER AND PRESSURE VESSEL CODE, SECTION IV FOR A MAXIMUM ALLOWABLE WORKING PRESSURE OF 160 PSI, *1103 kPa* WATER.

INSTALLER, THESE INSTRUCTIONS TO BE AFFIXED ADJACENT TO THE HEATER.

CONSUMER, RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE PURPOSES.

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BEFORE YOU START

This manual covers the application, installation, operation and maintenance of a LCD Series finned copper heating boiler/water heater/pool heater (Canada only).

To obtain the safe, dependable, efficient operation and long life for which this heating boiler/water heater was designed, these instructions must be read, understood and followed.

The LCD Series finned copper heating boiler/water heaters have been design certified by CSA for use with natural and propane gas under the latest revision of ANSI-Z21.10.3/CSA 4.3, Gas Water Heaters, and ANSI-Z21.13/CSA 4.9, Gas-Fired Low Pressure Steam and Hot Water Boilers and CAN1-3.1 Industrial and Commercial Gas Fired Boilers. Each unit has been constructed and hydrostatically tested for a maximum working pressure of **160 psi**, *1103 kPa* in accordance with Section IV of the A.S.M.E. Boiler and Pressure Vessel Code.

All aspects of the boiler/water heater installation must conform to the requirements of the authority having jurisdiction, or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision. Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

In Canada, the installation must be in accordance with the requirements of CSA B149.1 or .2, Installation Code for Gas Burning Appliances and Equipment.

If installed in the Commonwealth of Massachusetts, you MUST FOLLOW the additional instructions located in the back of this manual (MACODE-3).

The owner should maintain a record of all service work performed with the date and a description of the work done. Include the name of the service organization for future reference.

Direct all questions to your RBI distributor or contact the RBI Customer Service Department, 260 North Elm Street, Westfield, MA 01085 for U.S. or 7555 Tranmere Drive, Mississauga, ONT L5S 1L4 for Canada. Always include the model and serial numbers from the rating plate of the boiler/water heater in question.

RATINGS & CAPACITIES

Before undertaking the installation of the LCD Series boiler/water heater check the rating plate to ensure that the unit has been sized properly for the job. The "Net AHRI Ratings" specify the equivalent amount of direct cast iron radiation that the unit can supply under normal conditions. Also ensure that the unit has been set up for the type of gas available at the installation site. Other important considerations are the availability of an adequate electrical supply, fresh air for combustion and a suitable chimney or vent system.

BOILER/WATER HEATER LOCATION

1. This boiler/water heater is suitable for indoor and outdoor installations. Locate the boiler/water heater in an area that provides good access to the unit. Servicing may require the removal of jacket panels. Allow the minimum clearances between adjacent construction and the boiler/water heater as listed in Table 1.

NOTICE Service clearances are not mandatory, but are recommended to ensure ease of service should it be required.

Table 1

	Clearance to Combustibles		Service Clearance	
	in	*mm*	**in**	*mm*
Top	**6**	*153*	**20**	*508*
Back	**6**	*153*	**24**	*610*
Left Side	**6**	*153*	**24**	*610*
Right Side	**6**	153	**24**	*610*
Front	**6**	*153*	**30**	*762*
Flue	**6**	*153*		

2. An optimum site will be level, central to the piping system, close to a chimney or outside wall and have adequate fresh air for combustion. Ensure that the boiler/water heater is level from front to back and from side to side. Use metal shims to level the boiler/water heater. Electrical and electronic components must also be protected from exposure to water during operation and maintenance. DO NOT install this boiler/water heater in a location that would subject any of the gas ignition components to direct contact with water or excessive moisture during operation or servicing.
3. Ensure that the floor is structurally sound and will support the weight of the boiler/water heater.

NOTICE The LCD may be installed directly on combustible flooring, but never on carpeting.

4. Locate the boiler/water heater in an area that will prevent water damage to adjacent construction should a leak occur or during routine maintenance. If such a location doesn't exist, a suitable drain pan that's adequately drained must be installed under the unit.
5. DO NOT place this boiler/water heater in a location that would restrict the introduction of combustion air into the unit or subject the air inlet to a negative pressure, see "GENERAL VENTING GUIDELINES".

WARNING Never store combustible materials, gasoline or any product containing flammable vapors or liquids in the vicinity of the boiler/water heater. Failure to comply with this warning can result in an explosion or fire causing extensive property damage, severe personal injury or death!

6. NEVER place this boiler/water heater in a location that would subject it to temperatures at or near freezing. See the "Freeze Protection Section" on page 14.

CAUTION Units installed outdoors MUST be protected from ice and snow accumulation or the unit will be damaged voiding the warranty!

COMBUSTION AIR & VENTILATION

WARNING This boiler/water heater must be supplied with combustion air in accordance with Section 5.3, Air for Combustion & Ventilation, of the latest revision of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and all applicable local building codes. Canadian installations must comply with CSA B149.1 or .2 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes. Failure to provide adequate combustion air for this boiler/water heater can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

To operate properly and safely this boiler/water heater requires a continuous supply of air for combustion. NEVER store objects on or around the boiler/water heater!

CAUTION Combustion air contaminated with fluorocarbons or other halogenated compounds such as cleaning solvents and refrigerants will result in the formation of acids in the combustion chamber. These acids will cause premature failure of the boiler/water heater voiding the warranty!

CAUTION If the boiler/water heater is operated while the building is under construction it MUST be protected from wood, concrete, sheet rock and other types of dust. Failure to properly protect the unit from construction dust will damage the unit voiding the warranty!

Buildings will require the installation of a fresh air duct or other means of providing make-up air if the intake air option isn't used. Any building utilizing other gas burning appliances, a fireplace, wood stove or any type of exhaust fan must be checked for adequate combustion air when all of these devices are in operation at one time. Sizing of an outside air duct must be done to meet the requirements of all such devices.

WARNING Never operate the LCD in an environment subjected to a negative pressure unless the air intake is connected to the outdoors. Failure to comply with this warning can result in excessive levels of carbon monoxide causing severe personal injury or death!

All Air From Inside The Building

If the LCD is to be located in a confined space the minimum clearances listed in Table 1 must be maintained between it and any combustible construction. When installed in a confined space **without the intake air option**, Figures 1, 2 & 3, two permanent openings communicating with an additional room(s) are required. The combined volume of these spaces must have sufficient volume to meet the combustion air requirements of all gas utilization equipment. Fireplaces, wood stoves or any type of exhaust fan must be considered when making this determination. Each opening must have a minimum free area of **1 in²/1000 Btu/hr**, *2200 mm² kW* based on the total input rating of ALL gas utilization equipment in the confined area. Each opening must be no less than **100 in²**, *64,516 mm²* in size. The upper opening must be within **12 in**, *305 mm* of, but not less than **3 in**, *76 mm* from, the top of the enclosure. The bottom opening must be within **12 in**, *305 mm* of, but not less than **3 in**, *76 mm* from, the bottom of the enclosure.

Figure 1 Vertical venting with a metal chimney system and inside air

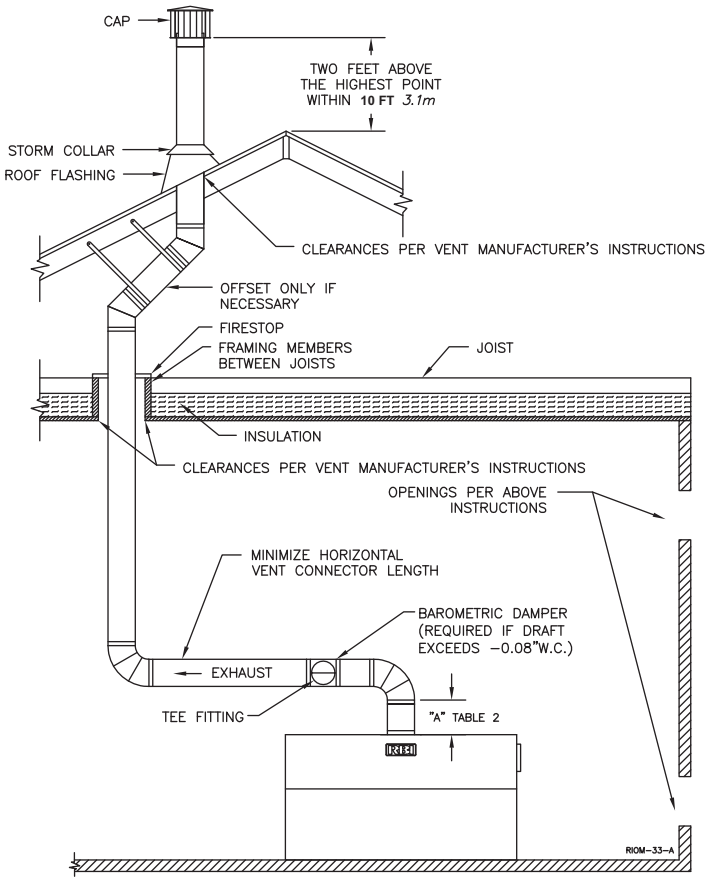


Figure 2 Vertical venting using a masonry chimney system and inside air

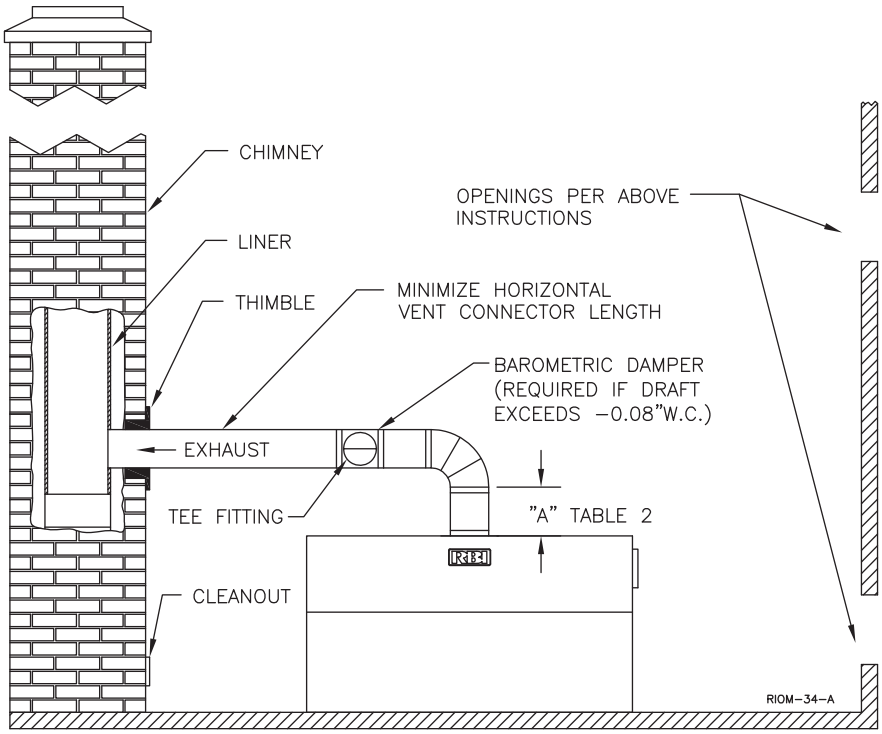


Figure 3 Horizontal venting using inside air

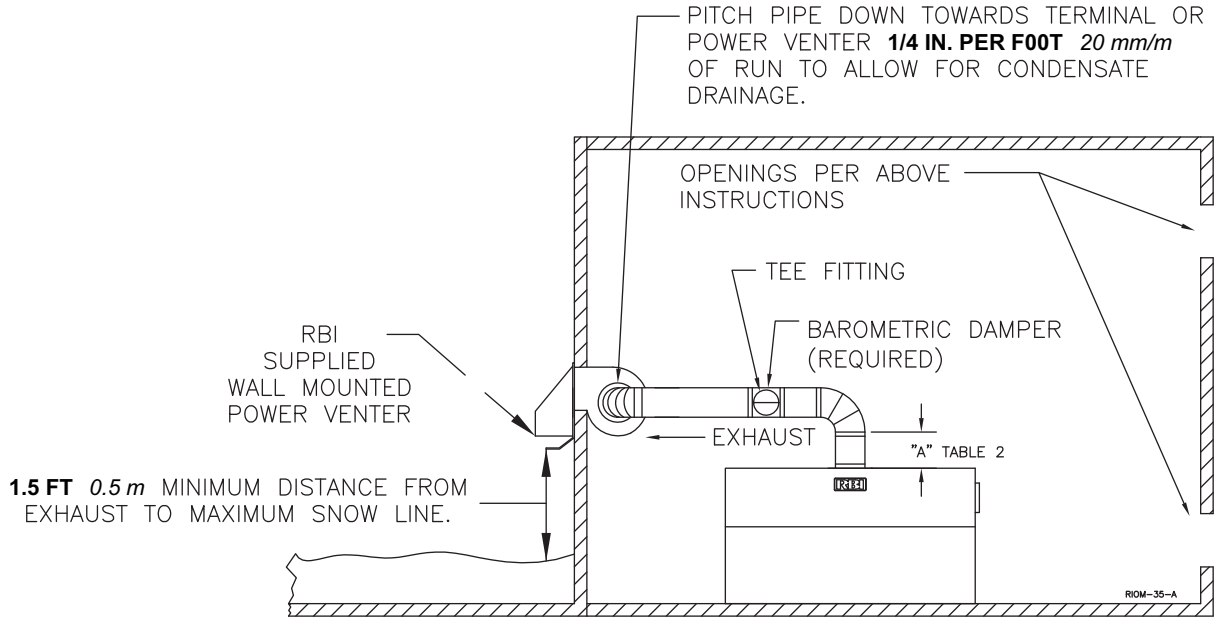


Table 2

VENT PIPE DIAMETER		MINIMUM VERTICAL RISE OFF THE TOP OF UNIT "A"	
IN.	*mm*	FT	*mm*
5" TO 10"	*127 TO 254*	12"	*305*
12" TO 18"	*305 TO 457*	24"	*610*

All Air From Outside The Building

When installed in a confined space **without utilizing the intake air option** two permanent openings communicating directly with, or by ducts to, the outdoors or spaces that freely communicate with the outdoors must be present. The upper opening must be within **12 in**, *305 mm* of, but not less than **3 in**, *76 mm* from, the top of the enclosure. The bottom opening must be within **12 in**, *305 mm* of, but not less than **3 in**, *76 mm* from, the bottom of the enclosure.

Where directly communicating with the outdoors or communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of **1 in²/4000 Btu/hr**, *550 mm²/kW* of the total input rating of all of the equipment in the enclosure.

Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of **1 in²/2000 Btu/hr**, *1100 mm²/kW* of the total input rating of all of the equipment in the enclosure. When louvers and screens are used, they must have the same cross-sectional area as the free area of the opening to which they connect.

When calculating the free area necessary to meet the make-up air requirements of the enclosure,consideration must be given to the blockage effects of louvers, grills and screens. Screens must have a minimum mesh size of **1/4 in**, *6.4mm*. If the free area through a louver or grill is not known, ducts should be sized per Table 3.

Table 3 Make-up air louver sizing

Input (MBH)	Required Cross Sectional Area					
	1/4 in *6.4 mm* Wire Screen		75% Free Area Metal Louvers		25% Free Area Wooden Louvers	
	in²	*cm²*	**in²**	*cm²*	**in²**	*cm²*
225	**57**	*363*	**75**	*484*	**225**	*1452*
300	**75**	*484*	**100**	*645*	**300**	*1935*
399	**100**	*645*	**133**	*858*	**399**	*2573*
600	**150**	*968*	**200**	*1290*	**600**	*3870*
750	**190**	*1210*	**250**	*1613*	**750**	*4840*
1050	**263**	*1696*	**350**	*2258*	**1050**	*6773*
1200	**300**	*1936*	**400**	*2580*	**1200**	*7740*
1480	**370**	*2388*	**494**	*3182*	**1480**	*9546*
1650	**413**	*2662*	**550**	*3548*	**1650**	*10,643*
1970	**493**	*3179*	**657**	*4236*	**1970**	*12,707*
2300	**575**	*3711*	**767**	*4945*	**2300**	*14,835*

Canadian installations must comply with CSA B149.1 when ***air supply*** is provided by natural air flow from the outdoors for ***natural draft***, partial fan-assisted, fan-assisted, or power draft-assisted ***burners***, there shall be a permanent ***air supply*** opening(s) having a cross-sectional area of not less than **1 in² per 7,000 Btuh** *(310 mm² per kW)* up to **and including 1 million Btuh,** plus **1 in² per 14,000 Btuh** *(155 mm² per kW)* **in excess of 1 million Btuh**.

Intake Air Option - General Guidelines

This configuration provides combustion air directly to the boiler/water heater's air intake using a dedicated pipe to obtain combustion air from the outdoors. Combustion air can be drawn in horizontally through an outside wall or vertically through the roof, see Figures 4, 5, 6 & 7.

WARNING Common intake air systems may be used to provide the common duct is sized properly and an intake combustion air damper is installed in the intake air pipe of each heater. Improper installation can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

Single wall galvanized smoke pipe, single wall aluminum pipe or flexible aluminum pipe can be used for the in-take air pipe. It must be sized per Table 4. All joints in metal combustion air systems must be secured using corrosion resistant fasteners and sealed using a suitable Silicon caulk or tape. **The combustion air system MUST be supported by the building structure not the boiler/water heater.**

Table 4 Combustion air pipe sizing

Model Size	Pipe Diameter	
	in	*mm*
225 - 300	**5**	*127*
400	**6**	*152*
600 - 750	**8**	*203*
1050	**10**	*254*
1200 - 2300	**12**	*305*

CAUTION A combustion air damper interlocked with the unit should be installed in the intake air pipe when the infiltration of sub-freezing air could occur, otherwise the unit could freeze up voiding the warranty!

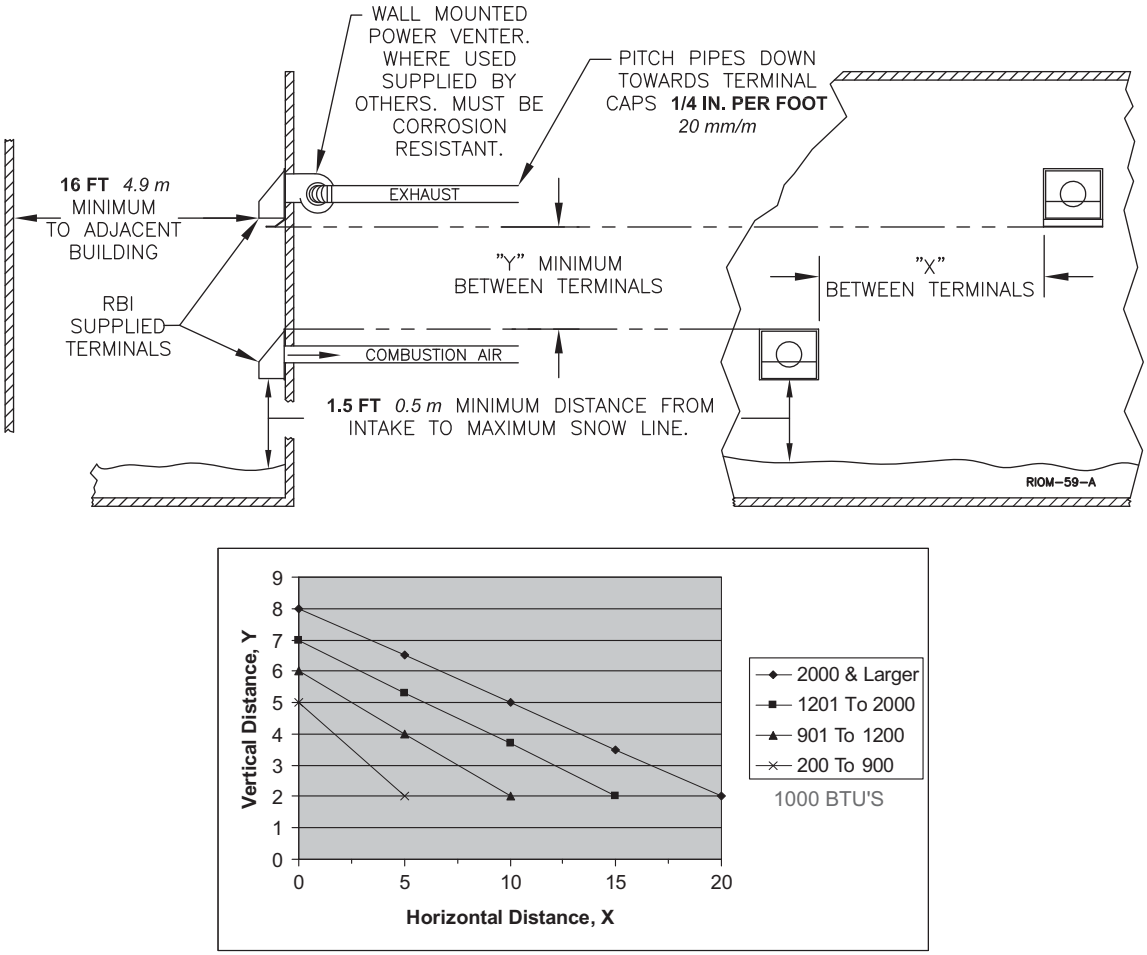
Intake Air Option - Horizontal Guidelines

The maximum equivalent length for the horizontal combustion air pipe on installations that used the Direct Vent option is **35 ft**, *10.8 m*. The maximum equivalent length for the horizontal combustion air pipe on installations that use the Horizontal Vent option is **100 ft**, *30.5 m*. Each 90° elbow and the combustion air terminal are equal to **10 linear ft**, *3.0 m* of pipe. If horizontal runs exceed **5 ft,** *1.5 m* they must be supported at **3 ft**, *0.9 m* intervals with overhead hangers. The certified combustion air terminal from RBI must be used and installed as shown in Figures 4 and 5.

Intake Air Option - Vertical Guidelines

The maximum length for the vertical combustion air pipe is **30 ft**, *9.1 m* plus two 90° elbows. A listed, nonrestrictive combustion air cap must be used. The combustion air cap must terminate as shown in Figure 6. The penetration point in the roof must be properly flashed and sealed.

Figure 4 Horizontal combustion air and venting for a single unit


WALL MOUNTED POWER VENTER. WHERE USED SUPPLIED BY OTHERS. MUST BE CORROSION RESISTANT.
PITCH PIPES DOWN TOWARDS TERMINAL CAPS 1/4 IN. PER FOOT 20 mm/m
16 FT 4.9 m MINIMUM TO ADJACENT BUILDING
EXHAUST
"Y" MINIMUM BETWEEN TERMINALS
"X" BETWEEN TERMINALS
RBI SUPPLIED TERMINALS
COMBUSTION AIR
1.5 FT 0.5 m MINIMUM DISTANCE FROM INTAKE TO MAXIMUM SNOW LINE.
RIOM–59–A
Vertical Distance, Y
Horizontal Distance, X
2000 & Larger
1201 To 2000
901 To 1200
200 To 900
1000 BTU'S

When running horizontal combustion air and venting for single or multiple units, exhaust and combustion air terminals must be installed on the same plane (outside wall) in order to prevent pressure differences due to prevailing winds. In cold climates, double-wall or insulated inlet pipe recommended to prevent condensation.

Figure 5 Horizontal combustion air and venting for a multiple units

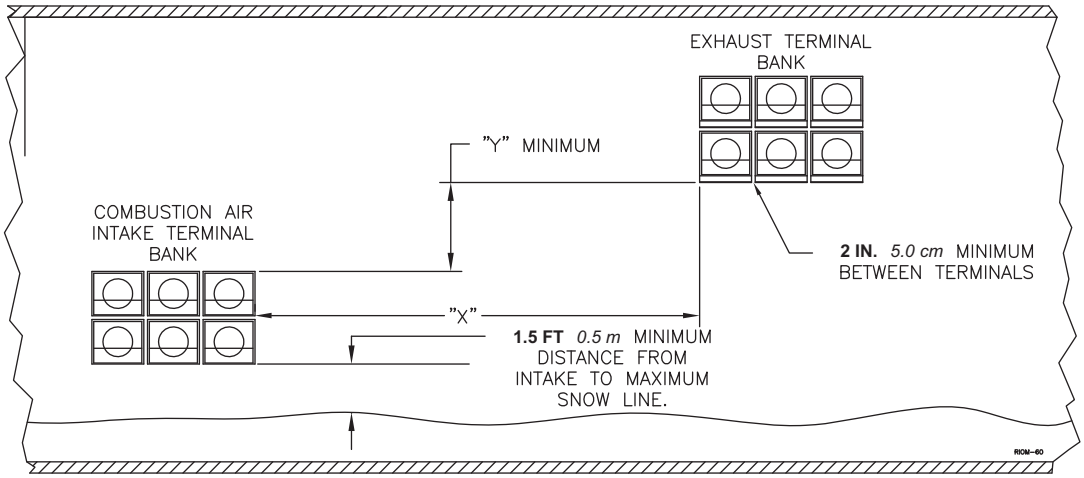

EXHAUST TERMINAL BANK
"Y" MINIMUM
COMBUSTION AIR INTAKE TERMINAL BANK
2 IN. 5.0 cm MINIMUM BETWEEN TERMINALS
"X"
1.5 FT 0.5 m MINIMUM DISTANCE FROM INTAKE TO MAXIMUM SNOW LINE.
RIOM–60

Figure 6 Vertical combustion air and venting, metal chimney system shown
Locate exhaust terminal downwind from air intake to reduce potential for flue gas recirculation.

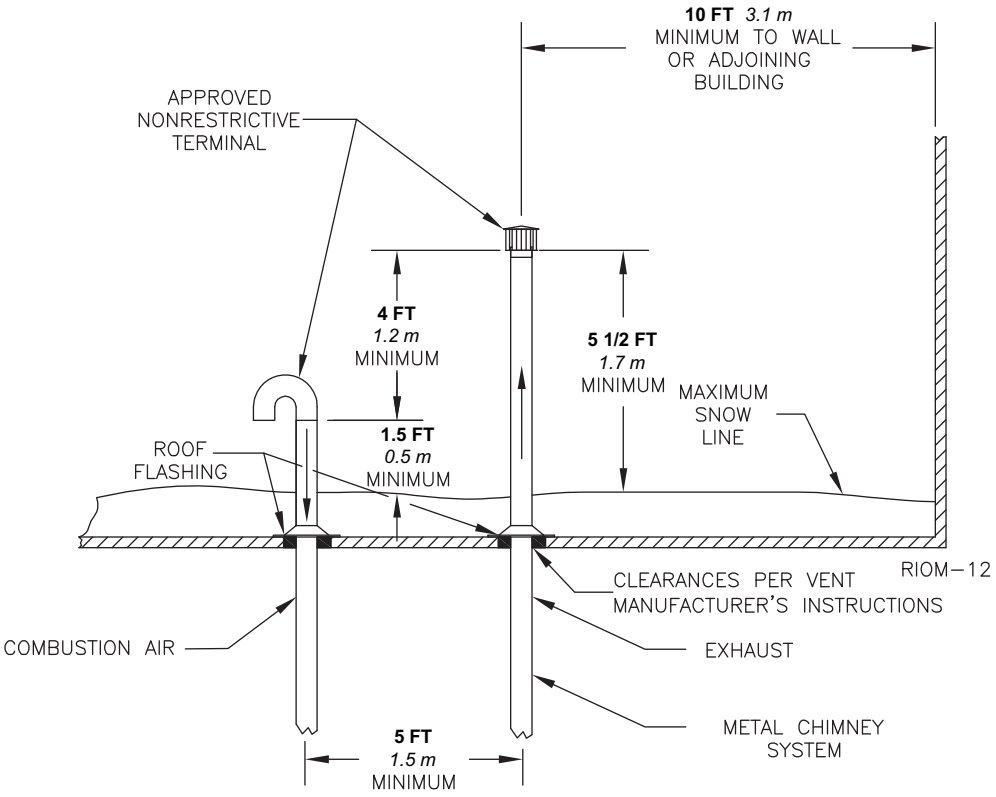
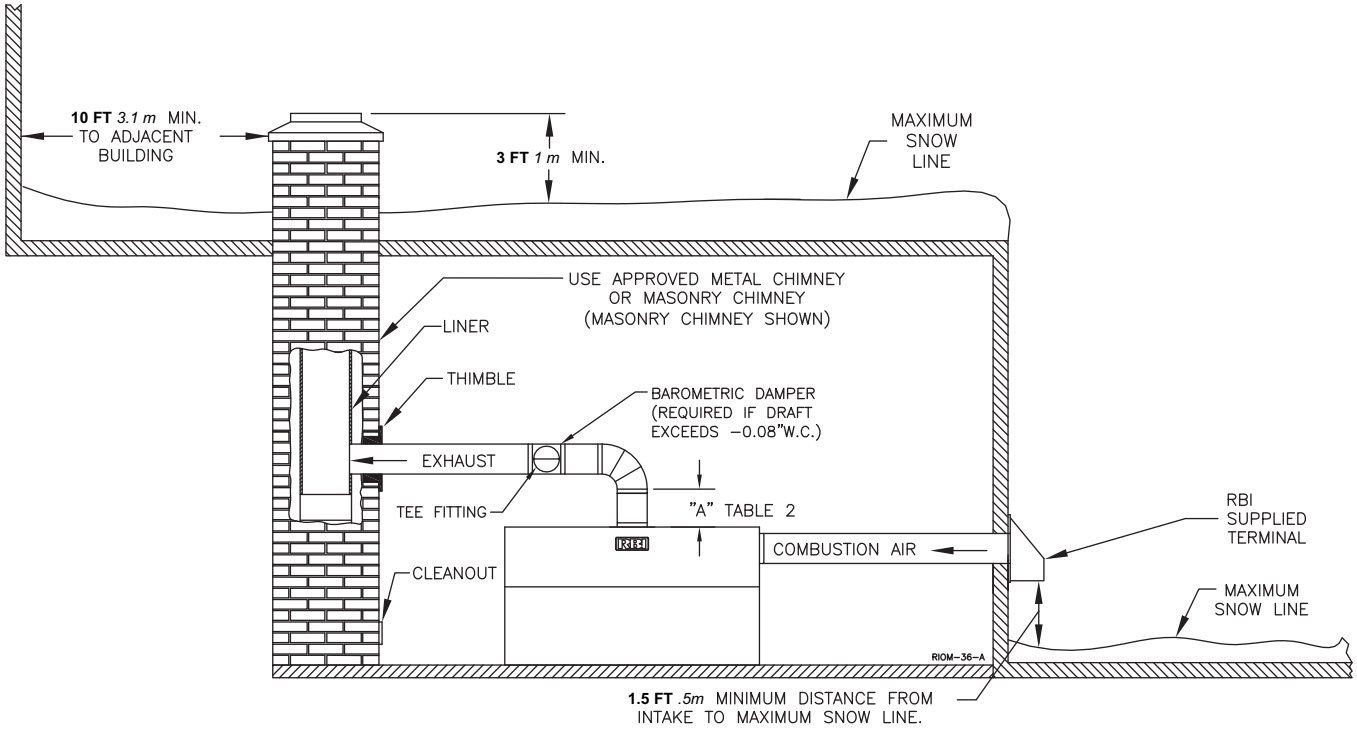


Figure 7 Combination air intake and venting, masonry chimney shown



GENERAL VENTING GUIDELINES

WARNING The vent installation must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision or applicable provisions of the local building codes. Canadian installations must comply with CSA B149.1 or .2 Installation Code. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

All vent systems must be fully supported by the building structure and not by the boiler/water heater. Appropriate thimbles and fire-stops must be used where required.

WARNING Common vent systems must be properly engineered and sized to provide a negative draft of **0.01 to 0.08 in**, *.25 to 2.0 mm* WC at the flue outlet! Common positive pressure vent systems are not to be used. Improper installation can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

NOTICE A single acting barometric damper must be installed directly to the boiler/water heater flue outlet to ensure proper operation. This does not apply to outdoor units or direct vent positive pressure units.

NOTICE Some venting applications may require the stop to be removed for smooth operation. The barometric damper should be located after the flue collector, refer to Figures 2, 7A and 8 for proper location. Be sure that the damper is mounted horizontally (never vertically). Carefully follow the instructions provided with the barometric damper. Check with local codes for specific requirements.

In Canada, B149 (7.25 Draft Regulators) states the damper shall be of double-acting type.

WARNING To avoid spillage into the room of dangerous flue gas containing carbon monoxide, the opening in damper must never face against the flow of flue gas.

VENT SYSTEM OPTIONS

The LCD may be vented the following ways:

1) ***Vertical/Chimney Venting, Negative Pressure, Category I*** - uses an approved metal chimney system or properly lined masonry chimney. Combustion air is obtained from the space in which the unit is installed or from outdoors. A barometric damper must be installed near the flue outlet when venting vertically. See Figures 6 and 7. This also applies to any fan-assisted chimneys or vents.

2) ***Direct Vent, Positive Pressure, Category III*** - for horizontal vent runs equivalent to **35 ft**, *10.8 m* or less. A stainless steel vent system certified to UL 1738 for installations in the United States. ULC S636 for installations in Canada must be used when combustion air is ducted from outdoors, from the same wall.

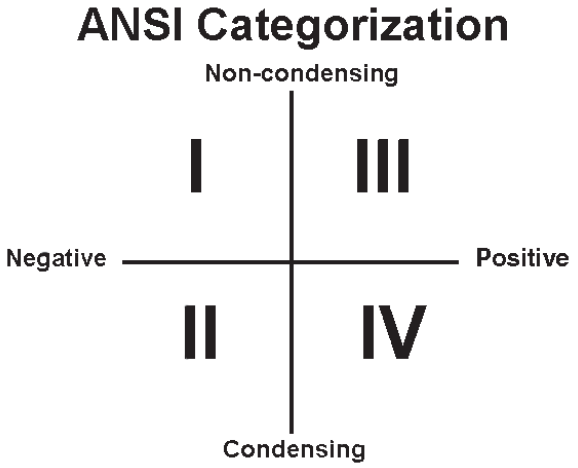
3) ***Horizontal Vent, Negative Pressure, Category I*** - for horizontal vent runs equivalent to more than **35 ft,** *10.8 m* (90° elbow equals 10 equivalent ft). A dedicated wall mounted power venter must be used. The vent system can be single wall galvanized steel or type B vent pipe. Combustion air is obtained from the space in which the unit is installed or from the outdoors.

   A barometric damper must be installed when the horzontal run is longer than 35 equivalent feet. (90° elbow = 10 equivalent ft). If this is the case, a power venter must also be used.

   If horizontal run is less than 35 equivalent ft, do not use a barometric damper. Follow applicable instructions under the "COMBUSTION AIR & VENTILATION" section.

4) ***Outdoor Installation*** - uses the outdoor option kit. Barometric damper is not required.

NOTICE All venting, combusiton air material supplied by installer. All venting material must be approved for the application. Consult the vent manufacturer's product literature



VERTICAL/CHIMNEY VENTING

The LCD is listed as a Category I appliance when vented vertically into a metal chimney system or properly sized masonry chimney, Figures 1, 2, 6 & 7. The chimney must provide a negative pressure of **0.01 to 0.08 in**, *.25 to 2.0 mm* WC at the boiler/water heater flue collar with the unit running at full load. A barometric damper must be installed between the flue collar and the vent connector. Approved thimbles and fire-stops must be used when combustible construction is penetrated.

WARNING If an appliance using any type of a mechanical draft system operating under positive pressure is connected to a chimney flue, never connect any other appliances to this flue. Doing so can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

Chimney Inspection & Sizing

A thorough inspection of the masonry chimney must be performed to ensure that the chimney is clean, properly constructed, lined and sized. Exterior masonry chimneys should not be used unless properly lined to prevent condensation and draft problems. Table 5 lists the equivalent breeching and flue sizes required for the boiler/water heater. When more than one appliance is connected to the same chimney flue, the flue must be large enough to safely vent the combined output of all of the appliances.

Table 5 Equivalent Breeching & Chimney Size

Model Size	Pipe Diameter	
	in	*mm*
225	**5**	*127*
300 - 400	**6**	*152*
600 - 750	**8**	*203*
1050	**10**	*254*
1200 - 1480	**12**	*305*
1650 - 2300	**14**	*356*

Note: These sizes are based on **20 ft**, *6.1 m* chimney height.

Vent Connections

Locate the boiler/water heater as close to the chimney as possible. Use the shortest, straightest vent connector possible for the installation. If horizontal runs exceed **5 ft**, *1.5 m* they must be supported at **3 ft**, *0.9 m* intervals with overhead hangers. Use a type B, single wall stainless or single wall galvanized steel vent pipe the same diameter as the flue collar to connect the boiler/water heater to a masonry chimney. When using an approved metal chimney system use the appropriate vent connector. The vent connector should be sloped up toward the chimney at a minimum rate of **1/4 in/ft**, *20 mm/m*. On masonry chimneys the connector must terminate flush with the inside of the chimney flue, Figure 2. Fasten each single wall vent connection with at least 3 corrosion resistant sheet metal screws.

WARNING Never install a vent pipe having a diameter different than that of the boiler/water heater flue collar. Failure to comply with this warning can result in excessive levels of carbon monoxide which can cause severe personal injury or death.

Always provide a minimum clearance of **6 in**, *152 mm* between single wall vent pipe and any combustible materials. Type B1 vent may be used, clearance between it and any combustible material must be as listed.

WARNING Failure to maintain minimum clearances between vent connectors and any combustible material can result in a fire causing extensive property damage, severe personal injury or death!

DIRECT VENT, POSITIVE PRESSURE, CATEGORY III

In this configuration the boiler/water heater blower is used to push the flue products to the outdoors while drawing combustion air from the outdoors. The equivalent length of the vent and combustion air systems **must not** exceed **35 ft**, *10.7 m* for each. The Intake Air Option instructions under the "COMBUSTION AIR & VENTILATION" section must be followed! The vent system must be sized per Table 4.

Horizontal Direct Vent Systems - Figures 4 & 5

The vent materials used in horizontal vent systems must be certified to UL 1738 for installations in the United States, ULC S636 for installations in Canada. The certified vent terminal from RBI must also be used.

The maximum equivalent length for the horizontal vent and combustion air pipes is **35 ft**, *10.8 m* for each. Each 90° elbow and the intake air and vent terminals are equal to **10 ft**, *3.1 m* of straight pipe. To maximize the performance of single wall sheet metal vent systems locate 90° elbows as far from the boiler as possible and from one another. For best results, horizontal vent systems should be as straight as possible.

The vent system must be both gas tight and watertight. All seams and joints in metal pipes must be joined and sealed in accordance with the vent system manufacturer's instructions.

When horizontal vent runs exceed **5 ft**, *1.5 m* they must be supported at **3 ft**, *0.9 m* intervals with overhead hangers. The vent system must be pitched down, toward the vent terminal, **1/4 in/ft**, *20 mm/m*. If any part of a single wall metal vent system passes through an unheated space it must be insulated with insulation rated for **400°F**, *204°C*.

Horizontal vent systems shall terminate at least **4 ft,** *1.2 m* below, **4 ft**, *1.2 m* horizontally from or **1 ft**, *0.23 m* above any door, window or gravity air inlet into any building. It must not terminate less than **4 ft**, *1.2 m* horizontally from, and in no case above or below, unless a **4 ft**, *1.2 m* horizontal distance is maintained, from electric meters, gas meters, regulators and relief equipment and not less than **7 ft**, *2.1 m* from any adjacent public walkway. The bottom of the vent terminal(s) shall be located at least **5 ft**, *1.5 m* above the air intake terminal(s) unless there is a minimum **5 ft**, *1.5 m* horizontal separation between them. Avoid terminal locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases.

Vertical Direct Vent Systems - Figure 6

The maximum length for the vertical vent and combustion air pipes is **35 ft**, *10.7 m* plus two 90° elbows. If any part of a single wall metal vent system passes through an unheated space it must be insulated with insulation rated for **400°F**, *204°C*. Structural penetrations must be made using approved fire-stops.

A listed, nonrestrictive vent cap must be used. The top of a vertical vent system must extend at least **5 1/2 ft**, *1.7 m* above the roof surface that it passes through, **4 ft**, *1.2 m* above the intake air cap, see Figure 6.

HORIZONTAL VENT, NEGATIVE PRESSURE, CATEGORY I

In this configuration a wall-mounted power venter must be used to pull the flue products horizontally from the unit and vent them to the outdoors, see Figures 3, 4 & 5. The air for combustion is taken from the space in which the unit is installed, or from the outdoors. The applicable instructions under the "COMBUSTION AIR & VENTILATION" section must be followed!

To maximize the performance of single wall sheet metal vent systems locate 90° elbows as far from the boiler as possible and from one another. For best results, horizontal vent systems should be as short and straight as possible.

When horizontal vent runs exceed **5 ft**, *1.5 m* they must be supported at **3 ft**, *0.9 m* intervals with overhead hangers. The vent system must be pitched down, toward the vent terminal, **1/4 in/ft**, *20 mm/m*. If any part of a single wall metal vent system passes through an unheated space it must be insulated with insulation rated for **400°F**, *204°C*.

Horizontal vent systems shall terminate at least **4 ft**, *1.2 m* below, **4 ft**, *1.2 m* horizontally from or **1 ft**, *0.23 m* above any door, window or gravity air inlet into any building. It must not terminate less than **4 ft**, *1.2 m* horizontally from, and in no case above or below, unless a **4 ft**, *1.2 m* horizontal distance is maintained, from electric meters, gas meters, regulators and relief equipment and not less than **7 ft**, *2.3 m* from any adjacent public walkway. The bottom of the vent terminal(s) shall be located at least **5 ft**, *1.5 m* above the air intake terminal(s) unless there is a minimum **5 ft**, *1.5 m* horizontal separation between them. Avoid terminal locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases.

To determine the appropriate power venter for the boiler/water heater, see Table 6. Follow the power venter manufacturer's installation instructions.

Table 6 Power Venter Sizes

LCD Model	Power Venter Model	Max. Pipe Length	
		ft	*mm*
225-300	HS-1	**30***	*9.3*
400	HS-2	**100**	*31.0*
600	HS-2	**67****	*20.8*
750	HS-3	**100**	*31.0*
1050-1200	HS-4	**100**	*31.0*
1480-2300	HS-5	**100**	*31.0*

*Choose HS-2 for **100 ft**, Max. Pipe Length
Choose HS-3 for **100 ft, *31 m*, Max. Pipe Length

OUTDOOR VENTING

When installed outdoors the LCD must be fitted with the factory supplied outdoor vent hood and air intake hood, see Figure 8. Multiple units must be spaced per Figure 9.

The boiler/water heater must be at least **10 ft**, *3.1 m* from any door, window or gravity air inlet into any building and at least **3 ft**, *0.9 m* from any overhang unless local codes dictate differently.

Avoid locations where wind deflection off of adjacent walls, buildings or shrubbery might cause a downdraft. The unit(s) should be located at least **3 ft**, *0.9 m* from structures. Outdoor installations are not recommended in areas where the danger of snow blockage exists.

CAUTION Do not place the boiler/water heater in a location that would subject it to runoff from adjacent buildings or damage may occur voiding the warranty!

Figure 8 Outdoor venting

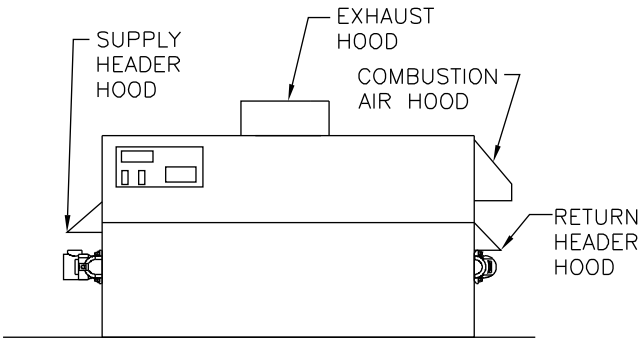
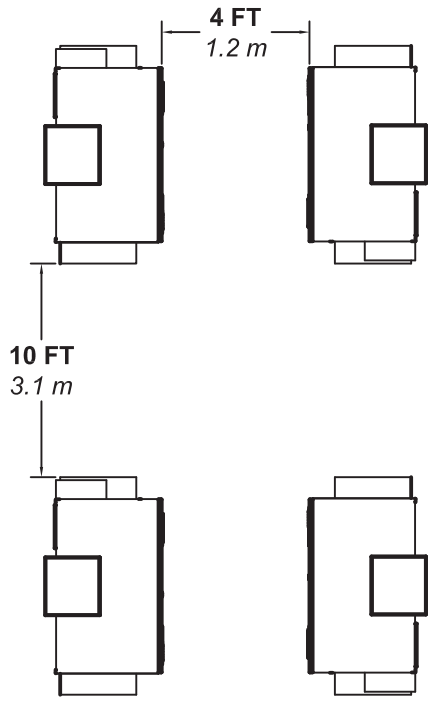


Figure 9 Multiple outdoor units



COMMON VENT SYSTEMS

If an existing boiler/water heater is removed from a common venting system, the common venting system may then be too large for the proper venting of the remaining appliances connected to it. At the time of removal of an existing boiler/water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonction-nent pas: système d'évacuation

a) Seal any unused openings in the common venting system.

Sceller toutes les ouvertures non utilisées du sys-tème d'évacuation.

b) Visually inspect the venting system for proper size and horizontal pitch and determine if there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

Inspecter de façon visuelle le système d'évacu-ation pour déterminer la grosser et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement de fruite, de corrosion et autres défaillances qui pourraient présenter des risques.

c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhaust, so they will operate at maximum speed. Do not operate a summer exhaust fan for a boiler installation. Close fireplace dampers.

Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés du système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sécheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinère et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.

d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.

e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.

Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allunette ou d'une chandelle ou la fumée d'une cigarette, d'un cigare ou d'une pipe.

f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.

Une fois qu'il a été d éterminé, selon la métode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façor adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.

g) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix F in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and or CAN/CGA-B149 Installation Codes.

Tout mauvais fonctionnement du systéme d'évacu-tion commun devrait étré corrigé de façor que l'installation soit conforme au National Fue Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CAN/CGA-B149. Si la grosseur d'une section du système d' évacuation doit étré modifiée, le système devrait étré modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/ NFPA 54 et (ou) des codes d'installation CAN/CGA-B149.

GENERAL PIPING REQUIREMENTS

CAUTION Improper piping of this boiler/water heater will void the manufacturer's warranty and can cause boiler failure resulting in flooding and extensive property damage! Excessive water hardness causing scaling in the copper heat exchanger tubes is NOT covered under the manufacturer's warranty. Excessive pitting and erosion of the internal surface of the copper heat exchanger tubes is NOT covered under the manufacturer's warranty if the result of high water flow rates, see Table 7. Return water temperatures below **125°F**, *52°C* will result in heat exchanger damage from excessive condensation voiding the manufacturer's warranty, see Primary/Secondary Piping Figure 11.

NOTICE Shut off valves and unions should be installed at the inlet and outlet connections of the boiler/water heater to provide for isolation of the unit should servicing be necessary.

Table 7 Temperature Rise Table

Model Number	**ΔT = 15°F Flow Rate GPM**	**Pres. Drop Ft**	*ΔT = 8.3°C Flow Rate L/s*	*Pres. Drop kPa*
225	**24.6**	**0.18**	*1.6*	*0.5*
300	**32.8**	**0.31**	*2.1*	*0.9*
400	**43.7**	**0.70**	*2.8*	*2.1*
600	**65.6**	**1.84**	*4.1*	*5.4*
750	**82.0**	**3.32**	*5.2*	*9.8*
Model Number	**ΔT = 20°F Flow Rate GPM**	**Pres. Drop Ft**	*ΔT = 11.1°C Flow Rate L/s*	*Pres. Drop kPa*
300	**24.6**	**0.18**	*1.6*	*0.5*
400	**32.8**	**0.41**	*2.1*	*1.2*
600	**49.2**	**1.08**	*3.1*	*3.2*
750	**61.5**	**1.95**	*3.9*	*5.7*
1050	**86.1**	**5.16**	*5.4*	*15.2*
1200	**98.4***	**8.14**	*6.2*	*24.0*
1480	**121.4***	**7.94**	*7.7*	*23.4*
Model Number	**ΔT = 25°F Flow Rate GPM**	**Pres. Drop Ft**	*ΔT = 13.9°C Flow Rate L/s*	*Pres. Drop kPa*
400	**26.2**	**0.27**	*1.7*	*0.8*
600	**39.4**	**0.71**	*2.5*	*2.1*
750	**49.2**	**1.29**	*3.1*	*3.8*
1050	**68.9**	**3.41**	*4.3*	*10.1*
1200	**78.7**	**5.38**	*5.0*	*15.9*
1480	**97.1**	**5.25**	*6.1*	*15.5*
1650	**108.2**	**7.02**	*6.8*	*20.7*
Model Number	**ΔT = 30°F Flow Rate GPM**	**Pres. Drop Ft**	*ΔT = 16.7°C Flow Rate L/s*	*Pres. Drop kPa*
600	**32.8**	**0.51**	*2.1*	*1.5*
750	**41.0**	**0.92**	*2.6*	*2.7*
1050	**57.4**	**2.44**	*3.6*	*7.2*
1200	**65.6**	**3.84**	*4.1*	*11.3*
1480	**80.9**	**3.75**	*5.1*	*11.0*
1650	**90.2**	**5.01**	*5.7*	*14.8*
1970	**107.7**	**8.75**	*6.8*	*25.8*
2300	**125.7***	**12.45**	*7.9*	*36.7*
Model Number	**ΔT = 35°F Flow Rate GPM**	**Pres. Drop Ft**	*ΔT = 19.4°C Flow Rate L/s*	*Pres. Drop kPa*
600	**28.1**	**0.38**	*1.8*	*1.1*
750	**35.1**	**0.69**	*2.2*	*2.0*
1050	**49.2**	**1.83**	*3.1*	*5.4*
1200	**56.2**	**2.89**	*3.5*	*8.5*
1480	**69.3**	**2.82**	*4.4*	*8.3*
1650	**77.3**	**3.77**	*4.9*	*11.1*
1970	**92.3**	**6.58**	*5.8*	*19.4*
2300	**107.8**	**9.36**	*6.8*	*27.6*

*Flow exceeds recommended maximum use a greater temperature rise or consult manufacturer. Cupro-nickel heat exchanger should be considered.

Freeze Protection

This boiler/water heater is CSA designed certified for outdoor installation. Outdoor installations in areas where the danger of freezing exists are not recommended unless proper freeze protection is provided. If the unit is to be installed in such an area the following precautions MUST be observed:

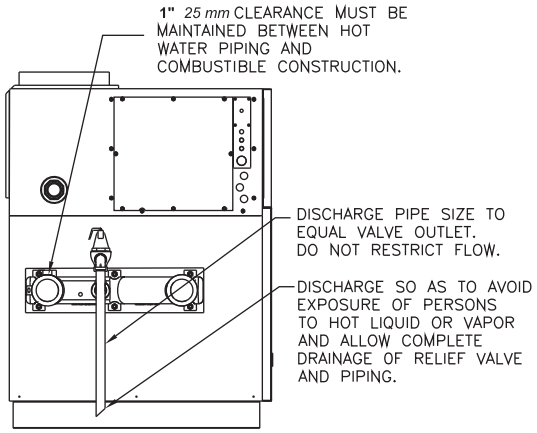
1. A continuous flow of water through the boiler/water heater MUST be maintained! The pump responsible for flow through the boiler/water heater must run continuously!
2. An ethylene glycol/water mixture suitable for the minimum temperature that the unit will be exposed to must be used. The pump must be capable of producing 15% more flow and overcoming a 20% increase in head loss. Domestic water systems must be isolated from the water heater by the use of a heat exchanger or other approved method.
3. If the boiler/water heater must be shut off for any reason the electric, gas and water supplies MUST be shut off and the unit and its pump completely drained.

CAUTION Improper outdoor installation of this boiler/water heater can cause boiler failure voiding the manufacturer's warranty!

Relief Valve

Pipe the discharge of the pressure relief valve to prevent scalding in the event of a discharge, see Figure 10. The discharge piping must be sized the same as the pressure relief valve outlet and installed to allow complete drainage of both the relief valve and the discharge piping.

Figure 10 Relief valve piping


1" 25 mm CLEARANCE MUST BE MAINTAINED BETWEEN HOT WATER PIPING AND COMBUSTIBLE CONSTRUCTION.
DISCHARGE PIPE SIZE TO EQUAL VALVE OUTLET. DO NOT RESTRICT FLOW.
DISCHARGE SO AS TO AVOID EXPOSURE OF PERSONS TO HOT LIQUID OR VAPOR AND ALLOW COMPLETE DRAINAGE OF RELIEF VALVE AND PIPING.

WARNING Never install any type of valve between the boiler/water heater and the relief valve or an explosion causing extensive property damage, severe personal injury or death may occur!

Flow Switch

The flow switch supplied with the boiler/water heater must be wired to the terminal strip in the control panel to prevent the boiler from firing unless there's adequate water flow through the unit. The flow switch must be installed in the supply piping adjacent to the boiler outlet connection.

CAUTION Failure to properly install the flow switch may result in damage to the boiler/water heater heat exchanger voiding the warranty!

HEATING SYSTEM PIPING

General Piping Requirements

All heating system piping must be installed by a qualified technician in accordance with the latest revision of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV, and when required, ANSI/ASME CSD-1, Standard for Controls and Safety Devices for Automatically Fired Boilers. All applicable local codes and ordinances must also be followed. A minimum clearance of **1 in**, *25 mm* must be maintained between heating system pipes and all combustible construction. All heating system piping must be supported by suitable hangers not the boiler.

The thermal expansion of the system must be considered when supporting the system. A minimum system pressure of **12 psig**, *82.7 kPa* must be maintained.

Heating Boiler Piping Connections

The supply and return piping should be sized to suit the system. The supply and return connection sizes are listed in Table 8.

Table 8 Supply & return connection sizes

Model Size	Supply Size	Return Size
225 thru 300	1 1/2" NPT	1 1/2" NPT
400 thru 2300	2 1/2" NPT	2 1/2" NPT

Pump Requirements (Primary/Secondary)

This low mass boiler requires a continuous minimum water flow for proper operation. The boiler pump must be sized to overcome the head loss of the boiler and the near piping in order to achieve the required temperature rise. Table 7 provides the heat exchanger pressure drop and temperature rise figures. The temperature rise across the boiler must never exceed **35°F**, *19.4°C*.

CAUTION A temperature rise outside of the range listed in Table 7 indicates that the flow rate through the heat exchanger is incorrect which will damage the heat exchanger voiding the warranty! The maximum allowable temperature rise is **35°F**, *19.4°C*.

The maximum allowable flow rate through a LCD boiler with copper heat exchanger is **92 GPM**, *5.8 L/s* on 225-1200 models and **115 GPM**, *7.3 L/s* on 1480 to 2300 models. The cupro-nickel heat exchanger allows for **100 GPM**, *6.3 L/s* on 225 to 1200 models and **125 GPM**, *7.9 L/s* on 1480 to 2300 models.

Low Water Cutoff

If a boiler is installed above any radiation elements it must be fitted with a low water cutoff device.

Refer to wiring diagram supplied with the boiler/water heater for proper wiring connections.

Expansion Tank & Air Separator

An expansion tank or other means to control thermal expansion must be installed in the heating system. An expansion tank must be installed close to the boiler on the suction side of the pump. An air scoop and automatic air vent must also be installed to eliminate air trapped in the system.

Primary/Secondary Piping

Boilers connected to heating systems using zone valves, zone pumps, or systems that have excessive flow rates or return water temperatures less than **125°F**, *52°C* must be isolated from these systems to protect the boiler.

Variable Water Flows

Figure 11 shows a typical primary/secondary piping system. A dedicated pump is used to maintain a constant water flow through the boiler. This boiler pump is sized to overcome the head loss of the boiler and near piping while supplying the flow rate required to maintain the desired temperature rise across the boiler heat exchanger. The system pump is sized to provide the required flow to the heating system.

Low Return Water Temperatures

To prevent the problems associated with condensation of the products of combustion due to low return water temperatures a primary/secondary piping system with a bypass and bypass valve must be installed, see Figure 12 and 12A. The bypass and bypass valve must be sized the same as the boiler piping. A balancing valve must also be installed in the supply side of the boiler piping downstream of the bypass. The balancing valve should be adjusted to divert some of the heated discharge water into the return water until the required inlet water temperature is achieved. The primary and secondary pumps should be sized to provide the required flow through each system.

Multiple Boiler Systems

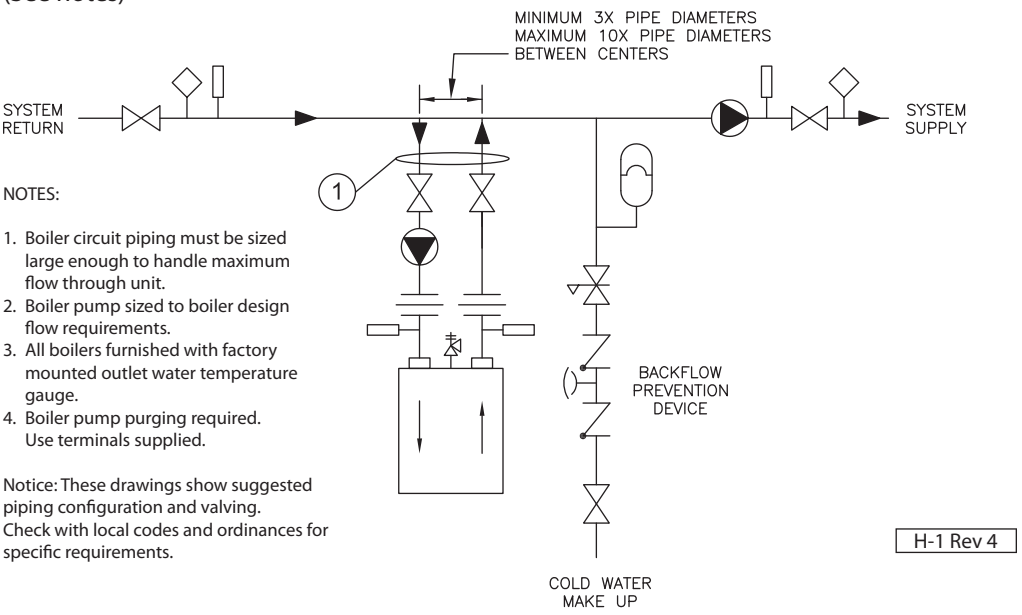
Systems using multiple boilers can also be installed using a primary/secondary manifold system, Figure 13.

Piping For Use With Cooling Units

The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler. Appropriate valves must be used to prevent the chilled water from entering the boiler.

When a boiler is connected to a heating coil that may be exposed to refrigerated air from an air handling device, the piping system must be equipped with flow-control valves or some other automatic means of preventing gravity circulation of the boiler water during the cooling cycle.

Figure 11 Typical primary/secondary piping system
(See notes)

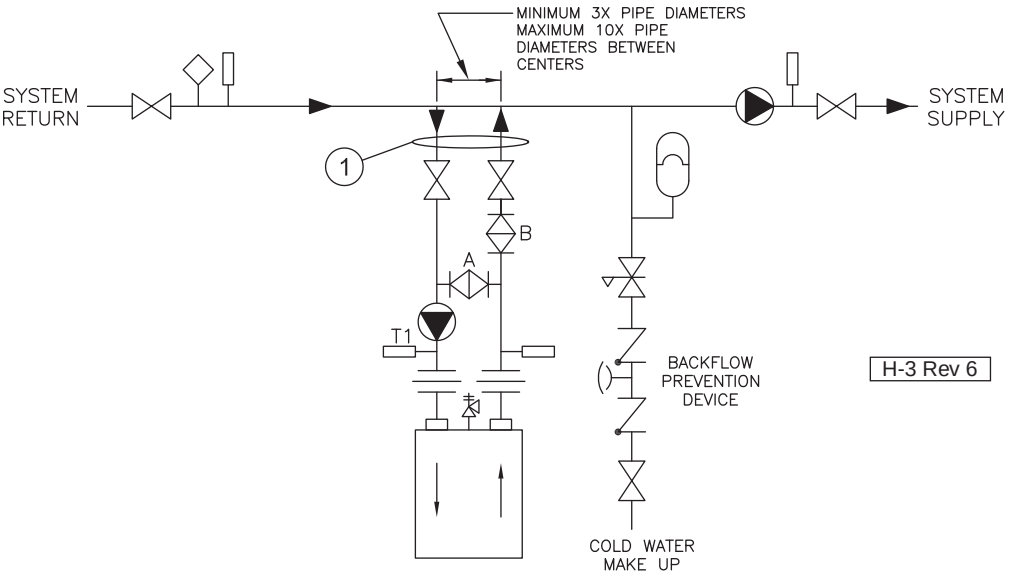


NOTES:

1. Boiler circuit piping must be sized large enough to handle maximum flow through unit.
2. Boiler pump sized to boiler design flow requirements.
3. All boilers furnished with factory mounted outlet water temperature gauge.
4. Boiler pump purging required. Use terminals supplied.

Notice: These drawings show suggested piping configuration and valving. Check with local codes and ordinances for specific requirements.

Figure 12 Low temperature piping
(See notes and adjustment procedures)



NOTES:

1. Boiler circuit piping must be sized large enough to handle maximum flow through unit.
2. Boiler pump sized to boiler design flow requirements.
3. All boilers furnished with factory mounted outlet water temperature gauge.
4. Boiler pump purging required. Use terminals supplied.

Notice: These drawings show suggested piping configuration and valving. Check with local codes and ordinances for specific requirements.

Adjustment Procedure To Maintain Inlet Temperature Above Dew Point
T1-Temp-Min=110°F For Atmospheric
T1-Temp-Min=125°F Sealed Combusion

1. Turn heater on and open valves A & B.
2. After steady-state operation, if T1 is less than Temp-Min slowly close valve B until T1 climbs to desired operating temperature above Temp-Min.
3. If T1 is greater than desired operating temperature, slowly close valve A to adjust to lower desired temperature above Temp-Min.
4. Check after system operating temperature has stabilized. Make final adjustments.
5. Follow same adjustment procedure for sealed combustion.

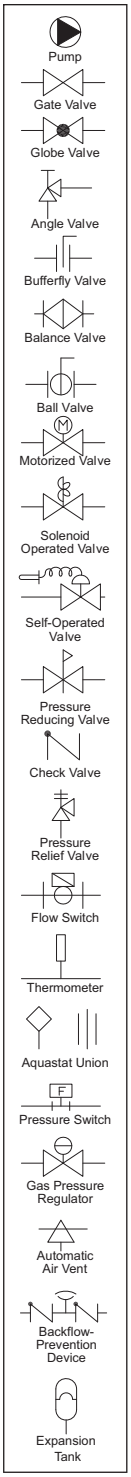
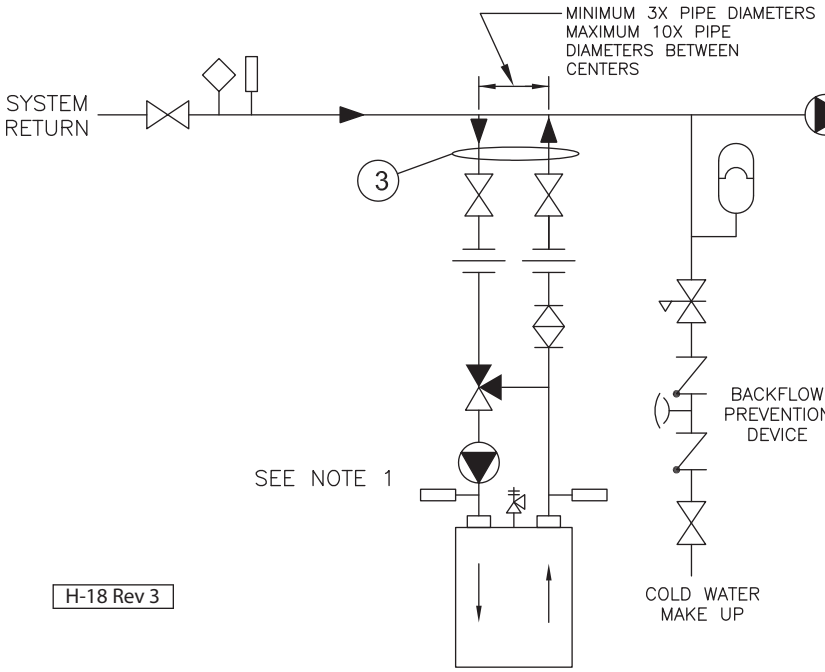


Figure 12A Low temperature piping with thermostatic valve
(See notes and adjustment procedures)

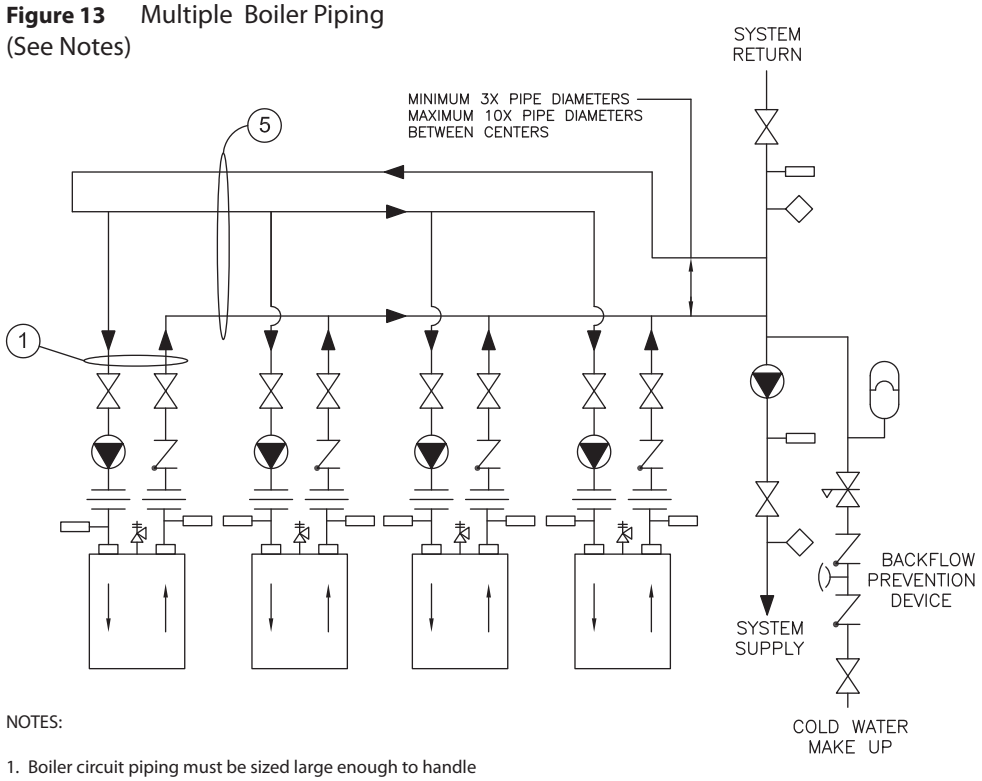


NOTES:

1. For pump selection consult factory.
2. Boiler pump sized to boiler and thermostatic 3-way valve design flow requirements.
3. Boiler circuit piping must be sized large enough to handle maximum flow through unit.
4. All boilers furnished with factory mounted outlet water temperature gauge.
5. Boiler pump purging required. Use terminals supplied.
6. Valve is precalibrated for 140°F return temperature.

Notice: These drawings show suggested piping configuration and valving. Check with local codes and ordinances for specific requirements.

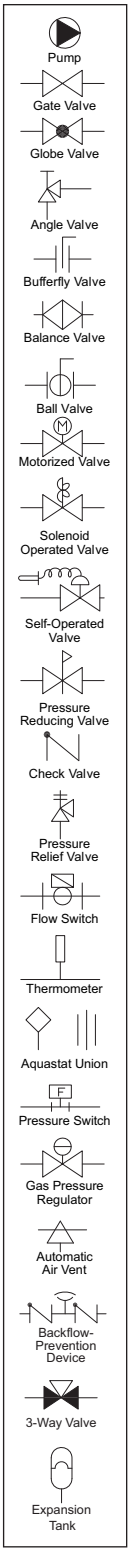
Figure 13 Multiple Boiler Piping
(See Notes)



NOTES:

1. Boiler circuit piping must be sized large enough to handle maximum flow through unit.
2. Boiler pump sized to boiler design flow requirements.
3. All boilers furnished with factory mounted outlet water temperature gauge.
4. Boiler pump purging required. Use terminals supplied.
5. Secondary loop pipe diameter must be sized large enough to handle maximum flow through all units.

Notice: These drawings show suggested piping configuration and valving. Check with local codes and ordinances for specific requirements.



DOMESTIC WATER SUPPLY PIPING

CAUTION Proper control settings must be used to prevent water supplied for domestic use from exceeding **130°F**, *54°C* or a scald injury will occur! When higher water temperatures are required for appliances such as a dishwasher, a mixing valve or some other tempering means must be installed. Households with small children may require water temperatures less than **120°F**, *49°C*. Local codes must be complied with!

General Piping Requirements

Ensure that the water heater is equipped with bronze headers. Piping and components connected to the water heater must be suitable for use with potable water. The water heater must not be connected to any heating system piping or components previously used with a non-potable water heating appliance. No toxic chemicals, such as those used for boiler treatment, are to be introduced into the potable water used for space heating. If a hot water storage tank is used in the system it must be equipped with a temperature and pressure relief valve that complies with ANSI Z21.22 or CAN-4.4 and CAN-4.6.

NOTICE The storage tank must be located as close to the water heater as possible to prevent excessive head loss which will reduce flow.

Water Chemistry

The required temperature rise across the water heater is based on water having a hardness between 8 and 18 grains per gallon with a level of dissolved solids not exceeding 350 ppm. Water having a hardness less than 8 grains can cause excessive errosion of the heat exchanger. Water that has a hardness greater than 18 grains per gallon and/or a level of dissolved solids exceeding 350 ppm will require a recalculation of the pump size and temperature rise.

A cupro-nickel heat exchanger may also be required. The manufacturer should be consulted when these water conditions are encountered. See Table 9A

CAUTION The maximum allowable flow rate through a LCD water heater with copper heat exchanger is **92 GPM**, *5.8 L/s* on 225 1200 models and **115 GPM**, *7.3 L/s* on 1480 to 2300 models. The cupro-nickel heat exchanger allows for **100 GPM**, *6.3 L/s* on 225 to 1200 models **125 GPM**, *7.9 L/s* on 1480 to 2300 models, see Table 9B .

RBI water heaters are designed to run scale free. Due to the extreme variables of water conditions world wide it is necessary to consider pH values and water hardness in relationship to scaling. It is crucial to consider these two variables when making heat exchanger and pump selection. If local water conditions are extreme follow the guidelines in the Heat Exchanger Selection Table (Table 9A) and the Pumping Performance Table (Table 9B). Scale free operation can be achieved by using water with a hardness between 8 and 18 and by maintaining the pH between 5 and 9. Follow the conditions listed under NORMAL in the table. In some areas of the country additional precautions must be observed due to unusual characteristics of the local water supply. Call the nearest RBI representative for details.

To properly size the pump a grain hardness and pH test must be taken at the installation site before the order is placed. Proper pump sizing will improve heater performance and help ensure heater longevity.

Expansion Tank

An expansion tank or other means to control thermal expansion must be installed in the water heating system if back flow prevention devices are installed.

Cold Water Supply

The cold water supply must be piped to the water heater's outlet piping between the water heater and the hot water storage tank. This will prevent untempered water from entering the water heater, see the Temperature Rise Control section below. A typical water heating system is shown in Figure 14 and 15.

Pump Requirements

This low-mass water heater requires a continuous minimum water flow for proper operation. The low water flow switch provided for this unit will shut down the water heater if flow falls below the required minimum level. Table 9B provides the heat exchanger pressure drop chart and temperature rise table. **The temperature rise across the water heater must never exceed 35°F,** *19.4°C***.**

Temperature Rise Control

Water returned to the water heater inlet must not be less than **125°F**, *52°C* or excessive condensation of the products of combustion will damage the water heater voiding the warranty. The method outlined below can be employed to prevent this condition from occurring.

A balancing valve should be installed on the outlet side of the water heater for purposes of adjusting the flow rate through the heat exchanger. Thermometers are installed on both the inlet and outlet of the water heater for determining the temperature rise through the unit. The proper velocity through the water heater must be maintained in accordance with Table 9B for efficient operation and long life. If the temperature rise through the water heater is lower than recommended the water velocity is too high. Premature erosion of the heat exchanger will occur. Conversely, if the temperature rise is higher than recommended in Table 9B the flow rate is too low. Scaling and softening of the heat exchanger will occur.

Thermostatic Mixing Valve - Water Above 140°F, *60°C*

Water can be stored at temperatures above **140°F**, *60°C* provided that a thermostatically controlled mixing valve is used to temper the hot water to an acceptable temperature before it's supplied for domestic use.

The mixing valve MUST be set to prevent a scald injury from occurring, see the caution against scalding above.

Storage of water for domestic use above **140°F**, *60°C* will provide an increased quantity of tempered water and help prevent growth of water born bacteria.

Table 9A LCD Heat exchanger selection graph

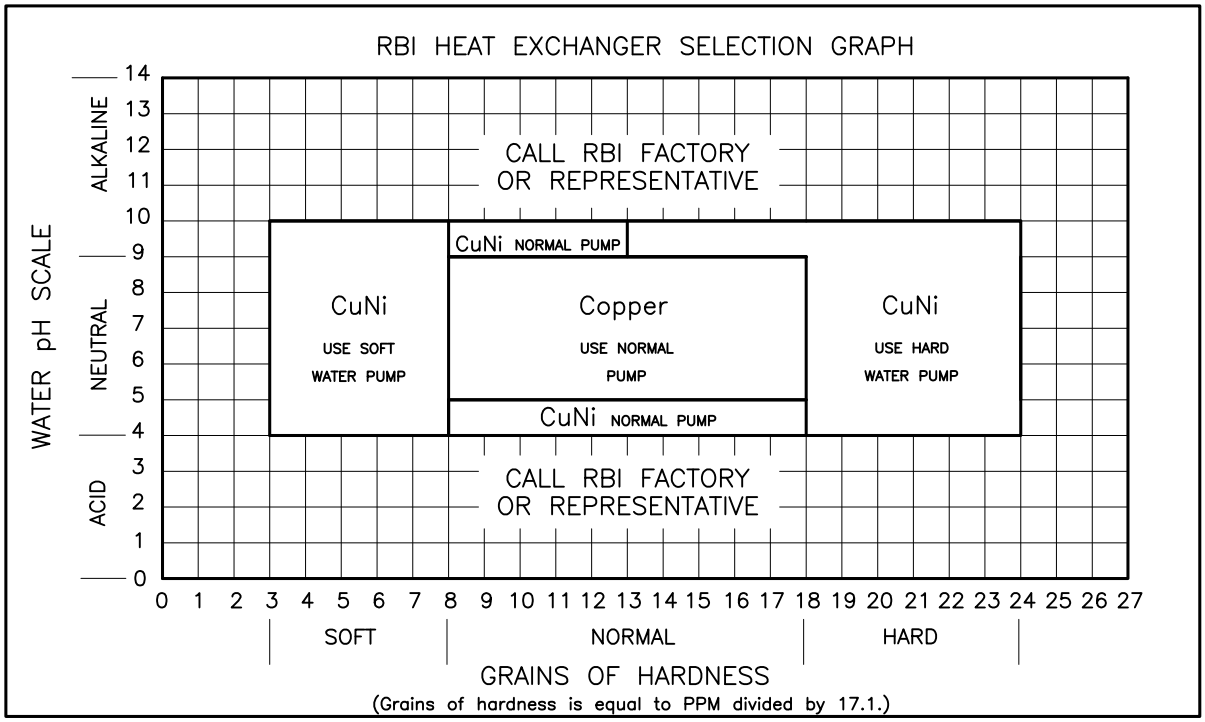


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Table 9B LCD Pumping performance requirement

LCD PUMPING PERFORMANCE REQUIREMENTS

WATER HARDNESS	SOFT			NORMAL			HARD		
HEAT EXCH. TYPE	CuNi			Copper			CuNi		
MODEL	GPM	ΔP	ΔT	GPM	ΔP	ΔT	GPM	ΔP	ΔT
LW–225	30	0.26	12.0	60	0.95	6.0	90	2.00	4.0
LW–300	30	0.26	16.0	60	0.95	8.0	90	2.00	5.0
LW–400	30	0.35	22.0	60	1.25	11.0	90	2.65	7.0
LW–600	30	0.43	33.0	60	1.56	16.0	90	3.30	11.0
LW–750	30	0.52	41.0	60	1.86	21.0	90	3.94	14.0
LW–1050	30	0.73	57.0	60	2.64	29.0	90	5.60	19.0
LW–1200	30	0.90	66.0	60	3.25	33.0	90	6.89	22.0
LW–1480	37	0.90	65.0	75	3.25	32.0	112	6.89	22.0
LW–1650	37	0.99	72.0	80	3.98	34.0	112	7.54	24.0
LW–1970	37	1.24	86.0	95	6.76	34.0	112	9.48	29.0
LW–2300	37	1.32	101.0	107	9.36	35.0	112	10.13	34.0

ΔT=Temperature Change=(Outlet Temp.–Inlet Temp.) in F°.
ΔP=Head Loss=(Inlet Pres.–Outlet Pres.) in feet of Water Column.
To achieve the proper flow rate adjust outlet valve on heater piping to obtain the correct ΔT.
Call factory if grains of hardness is less that 3 or greater than 24.

SPECIAL REQUIREMENTS
(CALL FACTORY OR REPRESENTATIVE)

Figure 14 Typical water heating piping (LW models only)
(See notes)

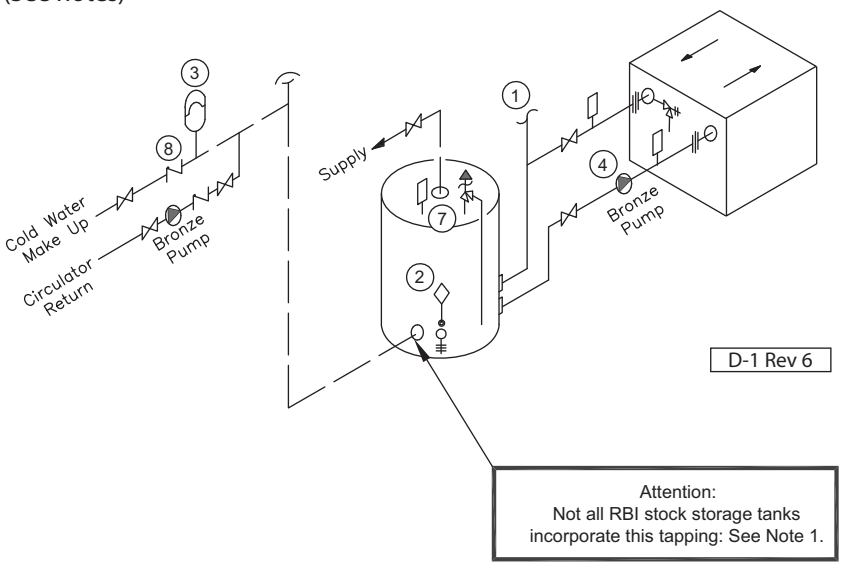
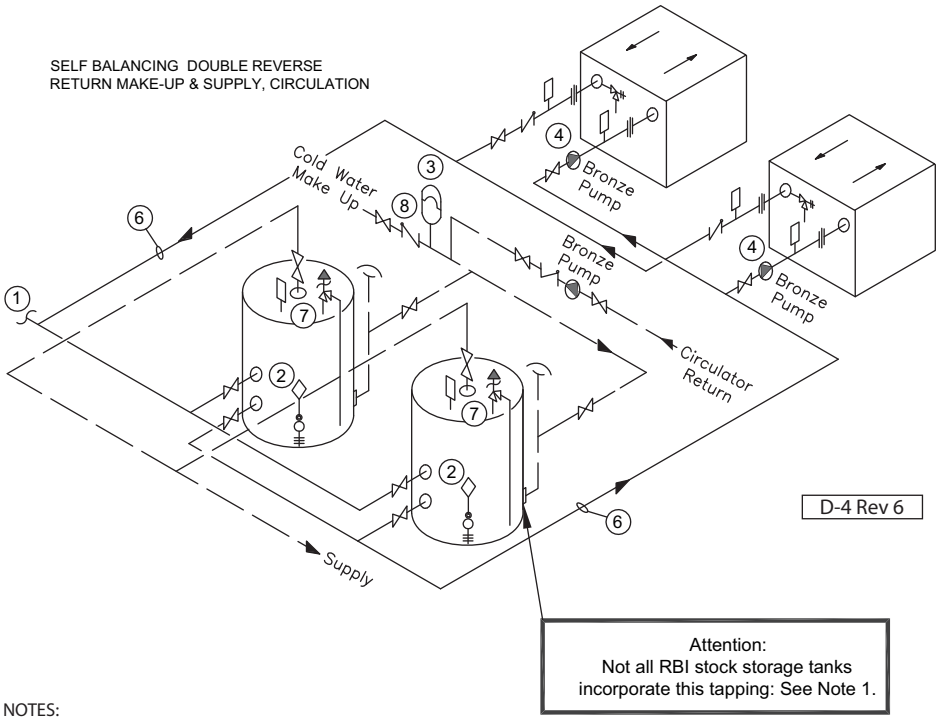
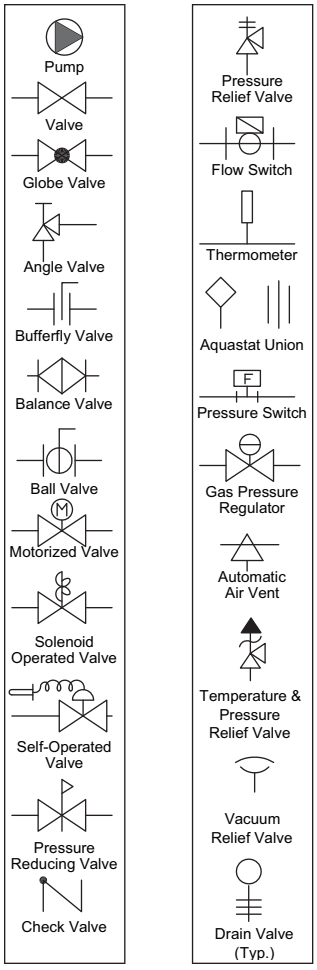


Figure 15 Multiple water heating piping (LW models only)
(See notes)



LEGEND:

Boiler Loop ——————
Supply Loop — — — —



NOTES:

1. Optional cold water make up and recirculation line location.
2. When using intermittent pump and pump delay, locate remote aquastat well in lower 1/3 of tank. Install aquastat with heat sensing compound.
3. Thermal expansion tank may be required, check local codes.
4. When using optional factory mounted pump, max pipe length 30' total, 6-90° elbows, full pipe size.
5. CAUTION: MEASURE WATER HARDNESS AND pH AT JOB SITE.
   The pH and water hardness must be measured before selecting heat exchanger and pump.
   Consult the Heat Exchanger Graph and Pumping Performance Table before making selection.
6. Common piping must be sized for maximum combined heater flow.
7. Hot water tanks should be equipped with a combination temperature & pressure relief valve.
8. MA Code requires an 1/8" hole in check valve to compensate for thermal expansion.

Notice: These drawings show suggested piping configuration and valving.
Check with local codes and ordinances for specific requirements.

GAS SUPPLY PIPING

WARNING Check the boiler/water heater rating plate to make sure that the boiler/water heater is for the type of gas that will be used. If it isn't, do not connect the boiler/water heater to the gas supply. Gas supply piping must be in accordance with the National Fuel code, ANSI Z223.1-latest revision or applicable provisions of the local building codes. Canadian installations must comply with CAN/CGA B149.1 or .2 Installation Code. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

The LCD comes from the factory ready to be piped to the gas supply. If for any reason the boiler/water heater is not for the type of gas available at the installation site, call your RBI Water Heaters representative to resolve the problem.

NOTICE A minimum gas supply pressure of **6 in**, *152 mm*, WC natural or **11 in**, *279 mm* WC propane and maximum **14 in**, *356 mm* WC natural or propane, must be available at the safety shutoff valve inlet with the unit(s) operating.

Table 10 should be used to ensure that the gas supply piping is sized properly. If more than one appliance is supplied by the same supply pipe, the piping must be sized based on the maximum possible demand. Do not neglect the pressure drop due to pipe fittings. Table 10 should be used in conjunction with Table 11 to ensure that the gas supply piping has the capacity to meet the demand.

Figure 16 depicts the proper way to connect the boiler/water heater to the gas supply piping. The manual shut-off valve must be installed in the supply piping. It should be installed **5 ft**, *1.5 m* above the floor where required by local codes. Provide a sediment trap at the bottom of the vertical section of the gas supply pipe upstream of the gas controls.

A ground joint union should be installed between the boiler gas controls and the supply piping. Each of these items are needed to ensure long life and ease of servicing. Always use a pipe sealant that is suitable for use with LP gas.

Table 10 Gas pipe capacity

Maximum pipe capacity in ft³/hr based on 0.60 specific gravity gas at a pressure of 0.5 psig or less and a 0.3" WC pressure drop.									
Nominal Iron Pipe Size	Pipe length in feet								
	10	20	30	40	50	60	80	100	150
	Maximum gas volume of pipe, (ft³/hr)								
3/4"	278	190	152	130	115	105	90	79	64
1"	520	350	285	245	215	195	170	150	120
1 1/4"	1050	730	590	500	440	400	350	305	250
1 1/2"	1600	1100	890	760	670	610	530	460	380
2"	3050	2100	1650	1450	1270	1150	990	870	710
2 1/2"	4800	3300	2700	2300	2000	1850	1600	1400	1130
3"	8500	5900	4700	4100	3600	3250	2800	2500	2000

Note: Multiply the gas volume by 0.62 for propane flow capacity in ft³/hr. Multiply the propane flow capacity by 2500 Btu/ft³ to determine the propane Btu/hr capacity for a given pipe size and length.

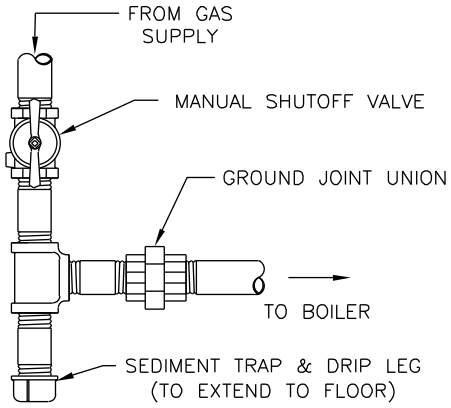
Table 11 Equivalent pipe length chart

Nominal Iron Pipe Size	Type of pipe fitting			
	90˚ Elbow	Tee[1]	Gate Valve[2]	Gas Cock[2]
	Equivalent pipe length, (ft)			
1"	2.6	5.2	0.6	1.5
1 1/4"	3.5	6.9	0.8	1.9
1 1/2"	4.0	8.0	0.9	2.3
2"	5.2	10.3	1.2	3.0
2 1/2"	6.2	12.3	1.4	3.7
3"	7.7	15.3	1.8	4.5

Notes: 1. For flow through branch.
2. For flow at full open.

CAUTION Always use a wrench on the gas valve body when making gas connections to it. Never over-tighten the piping entering the gas valve body or gas valve failure may result!

Figure 16 Gas supply piping



When applicable, provisions for vent, bleed and gas relief lines must be made in accordance with the latest revision of ANSI Z223.1/NFPA 54.

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler. All gas connections MUST be leak tested before putting the boiler into operation.

WARNING Never use an open flame to test for gas leaks. Always use an approved leak detection method. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

Whenever the gas supply piping is pressure tested the boiler/water heater gas controls must be protected. If the test pressure is equal to, or less than **1/2 psig**, *3.5 kPa* isolate the boiler/water heater by closing it's manual shut off valve, see Figure 16. If the test pressure is greater than, or equal to **1/2 psig**, *3.5 kPa*, disconnect the boiler/water heater and its individual shut-off valve.

ELECTRICAL WIRING

Electrical Power Connections

CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing.

Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretirn terminé.

The electrical connections to this boiler/water heater must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI/NFPA-70. Installation should also conform with CSA C22.1 Canadian Electrical Code Part I if installed in Canada.

Install a separate 120 volt 15 or 20 amp circuit breaker for the boiler/water heater and pump, see Table 12. A properly rated shut-off switch should be located at the boiler/water heater. The boiler/water heater must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Table 12 LCD electrical requirements

LCD Model	Recommended Circuit Breaker (Amps)	*Running Amps
LB/LW 250 - 600	15	3.9
LB/LW 750	15	6.0
LB/LW 1050 - 1970	20	11.4
LB/LW 2300	20	14.4

*Use separate circuit breaker that is properly sized for pump and pump contactor.

Line voltage field wiring of any controls or other devices must conform to the temperature limitation of type T wire at **95°F**, *35°C* above room temperature. Use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors. The wire size must be compatible with the total amp draw of the circuit.

Refer to the wiring diagram supplied with the boiler/water heater for proper wiring connections.

GENERAL OPERATION

WARNING Before proceeding read and fully understand the instructions contained in this manual. Do not attempt to operate this boiler/water heater if it has not been installed in accordance with the guidelines set forth in this manual. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance. Do not interrupt water flow through the boiler/water heater.

En cas de surchauffe ou si l'alimentation en gaz ne s'arrête pas, fermez manuellement le robinet d'arrêt de l'admission de gaz.

Hydronic Heating Boilers

Open the make-up water valve and slowly fill the boiler and all of the radiation with water. Ensure that all bleed and drain valves are closed.

Adjust the make-up water pressure regulator so a minimum **12 psig**, *83 kPa* system pressure is maintained at the highest point in the system piping. If a make-up water pump is used adjust it to maintain a minimum **12 psig**, *83 kPa* system pressure.

Open the system bleed and drain valves one at a time to purge the air trapped in the heating system piping.

With the boiler off, run the system pump for at least 30 minutes and bleed the system piping using the bleed valves. If strainers are used in the system piping, the make-up water valve should be closed and the strainers checked and cleaned.

The system expansion tank should be checked to ensure that the correct water level in the tank is maintained. The tank should be less than half full of water with the system full and adjusted to the correct operating pressure.

Start the boiler as described in the "OPERATING INSTRUCTIONS". Run the boiler for at least an hour. The system pump(s) and all radiation units must be operated during this time. Ensure that the make-up water valve is open.

Shut the boiler off and open the bleed valves to purge the air trapped in the heating system piping. Close the make-up water valve and check and clean the strainers and make-up water pressure reducing valve.

Open the make-up water valve and adjust the system pressure if necessary. The system should be checked and bled after three days of operation.

BOILER/WATER HEATER OPERATION

Staging Operation

The LCD boiler/water heater series is separated into on/off and 2-stage units depending on the model selected. The 225-400 models have on/off staging, while the 600 through 2300 models have a two stage option. Input staging is controlled from an aquastat controller that signals the relays to select the blower and gas valve modes. Per DOE mandate, the (LB225/300) operator control incorporates an automatic means (outdoor reset) of adjusting the boiler water temperature for hot water heating. The boiler will not operate without the outdoor sensor installed. Table 13 identifies the stages and firing modes associated with the standard single stage units. Table 14 identifies the stages and firing modes associated with the two stage option.

Table 13 Firing modes (L225-L2300)

Stage	Firing Mode
Off	Off
1	On

Table 14 Firing modes (L600-L2300)

Stage	Firing Mode
Off	Off
1	Low Fire
2	High Fire

The outlet water temperature is automatically controlled by the aquastat. The optional staging function is controlled by a return water aquastat. The return water aquastat utilizes inputs from the inlet water temperature sensors or optional tank sensors to stage the boiler/water heater as required.

Pressure Switch Settings

Differential pressure switches are provided in the LCD to shut down gas flow under a blocked flue or inlet condition. A single pressure switch is used on the standard models. One low fire and one high fire pressure switch is used when the two-stage option is employed. The low fire pressure switch serves to shut down gas flow if there is a blocked flue or inlet condition during low fire operation. Similarly, the high fire switches will shut down gas flow if there is a blocked flue or inlet condition during high fire operation. **The differential pressure is taken between the air plenum and the pressure inside one of the main burners.**

Pressure taps are provided in the control compartment for taking the differential pressure readings, Figure 17. Table 15 lists the differential pressure settings for all of the models.

Figure 17 Pressure switch tap(s)

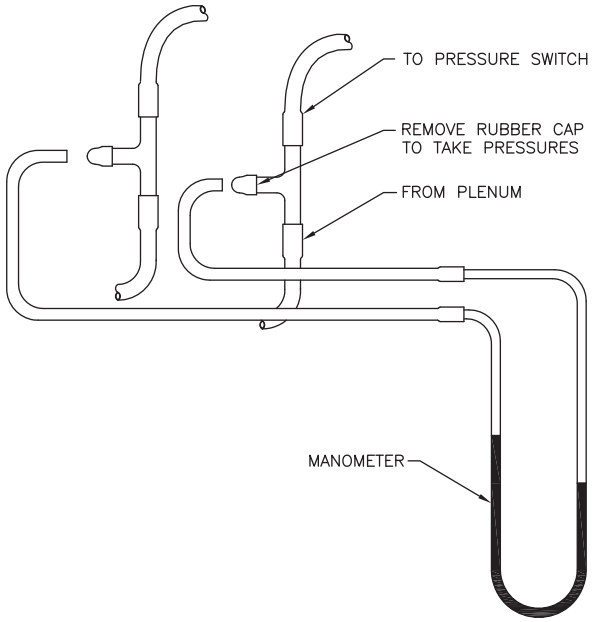


Table 15 Differential pressure settings (all units)

Model	Differential Pressure Requirement at High Fire (All Units)	
	Inches WC	*mm WC*
225-300	**1.0 ± 1.1**	*25.4 ± 27.9*
400	**0.7 ± 0.8**	*17.8 ± 20.3*
600-2300	**1.0 ± 1.1**	*25.4 ± 27.9*

On all units, the pressure switch(es) will interrupt power to the control module under a blocked flue or inlet condition. This will cause the pilot and main gas valves to close. Tables 16 and 17 identify how pressure switch control changes during boiler/water heater staging. Tables 18 and 19 identify the control actions if a low air condition occurs at any stage.

Table 16 Pressure switch control, L225-L400

Stage	Pressure Switch Mode
Off	Off
1	High Fire

Table 17 Pressure switch control, L600-L2300

Stage	Pressure Switch Mode
Off	Off
1	Low Fire
2	High Fire

Table 18 Low air condition action, L225-L2300

Stage	Control Action
1	No Power to Flame Sense Module

Table 19 Low air condition action, L600-L2300

Stage	Control Action
1	No Power to Flame Sense Module
2	No Power to Flame Sense Module

OPERATION SEQUENCE, ON/OFF L225 THROUGH L2300

NOTICE Refer to the wiring diagram included with the unit for further control system info.

POWER ON:

Demand for Heat:

1. The operator switch closes, energizing pump delay timer TD4 and the water pump(s).
2. Water flow through the unit closes the water flow switch contacts energizing blower delay timer TD3.
3. The system checks all primary limit(s) and other interlocks before starting pre-purge. The unit will not start if any switch is open.

Prepurge:

1. Blower delay timer TD3 energizes the high speed windings of the blower(s).
2. Air pressure in the combustion chamber is sensed. If the air pressure is sufficient, the pressure switch closes allowing the blower delay timer TD1 to start a 10 second pre-purge.

Ignition Trial:

1. Blower delay timer TD1 times out and the flame sense module, FSM, is energized.
2. The FSM starts the 10-second ignition trial, energizing relay R7, the pilot solenoid valve and the spark generator.
3. The pilot valve and spark generator are energized for the 10-second ignition trial. When the pilot flame is sensed, the FSM sends 24VAC to its MV terminal energizing the safety and main solenoid valves and relay R8, de-energizing relay R7 and the spark generator.
4. If the pilot flame isn't sensed, the FSM de-energizes the PV terminal and waits 5 minutes before initiating the second ignition trial. The blower(s), pump(s) and optional power venter will remain on during this time.
5. On CSD-1 equipped units the blower(s) and optional power venter will shut down and the boiler/water heater will lock if the second ignition trial fails. The unit must then be manually reset by depressing the reset button on the left jacket panel.
6. On non-CSD-1 equipped units the FSM will wait 10 minutes after the second unsuccessful ignition attempt then begin the ignition process described in step 3 above. The FSM will continue to cycle the unit through steps 3, 4 and 6 until the unit lights or the demand for heat is removed.

Main Burner

Once the pilot is proven, the MV terminal on the FSM is energized sending 24VAC to the safety and main solenoid valves.

Normal Operation

On single stage units the blowers and gas valves operate at one input.

Demand Satisfied:

1. When the demand for heat is satisfied the operator switch will open, de-energizing relay R8, TD1, TD3, TD4, the FSM, and the pilot, main and safety solenoid valves. The pilot and main flames are extinguished.
2. The blower delay timer TD3 starts the 80 second post-purge timing. The blower(s) shut(s) off when TD3 times out.
3. The pump delay timer TD4 starts the post-purge timing. The pump(s) remain on for 0.1 to 10 minutes then shut(s) off when TD4 times out.

High Limit, Low Water Flow, Low Gas Pressure, High Gas Pressure, Power Venter Interlock Faults

1. Electrical power to the gas valves, blower(s) and optional power venter will be interrupted if any safety is tripped.
2. The manual reset high limit can be reset by depressing the reset button on the left jacket panel.

Low Air (Blocked Flue/Air Inlet)

- The pressure switch will monitor blower airflow.
- Air monitoring will begin at pre-purge. If a low air condition is present power will not be supplied to the FSM. The blower(s) will remain on.

OPERATION SEQUENCE, 2 STAGE OPTION L600 THROUGH L2300

NOTICE Refer to the wiring diagram included with the unit for further control system info.

POWER ON:

Demand for Heat:

1. The low operator switch closes, energizing pump delay timer TD4 and the water pump(s).
2. Water flow through the unit closes the water flow switch contacts energizing blower delay timer TD3.
3. The system checks all primary limit(s) and other inter-locks before starting pre-purge. The unit will not start if any switch is open.

Prepurge:

1. Blower delay timer TD3 energizes the low speed windings of the blower(s).
2. Once sufficient air pressure in the combustion chamber is sensed the pressure switch closes allowing the blower delay timer TD1 to start a 10 second pre-purge.

Ignition Trial:

1. Blower delay timer TD1 times out and the flame sense module, FSM, is energized.
2. The FSM starts the 10-second ignition trial, energizing relay R7, the pilot solenoid valve and the spark generator.
3. The pilot valve and spark generator are energized for the 10-second ignition trial. When the pilot flame is sensed, the FSM sends 24VAC to its MV terminal energizing the safety and low fire-side of the main solenoid valves and relay R8, de-energizing R7 and the spark generator.
4. If the pilot flame isn't sensed, the FSM de-energizes the PV terminal and waits 5 minutes before initiating the second ignition trial. The blower(s), pump(s) and optional power venter will remain on during this time.
5. On CSD-1 equipped units the blower(s) and optional power venter will shut down and the boiler/water heater will lock if the second ignition trial fails. The unit must then be manually reset by depressing the reset button on the left jacket panel.
6. On non-CSD-1 equipped units the FSM will wait 10 minutes after the second unsuccessful ignition attempt then begin the ignition process described in step 3 above. The FSM will continue to cycle the unit through steps 3, 4 and 6 until the unit lights or the demand for heat is removed.

Main Burner

Once the pilot is proven, the FSM sends 24VAC to its MV terminal energizing the safety and low-fire side of the main solenoid valves.

Normal Operation

- Staging is controlled by the return water aquastat. Relays R2 and R2R are energized by the return water aquastat when more heat input is required. The hi-speed windings of the blower(s) are energized.
- Relay R9 is energized when the hi-fire pressure switch senses adequate air pressure to sustain hi-fire combustion. R9 energizes the hi-fire side of the main solenoid valve.
- Stage 1 will operate first and last.

NOTICE For a change from stage 1 to 2, a 30 second time delay is provided in the pressure switch switching circuit. The time delay TD6 provides a hold state that allows the blower to reach full speed and close the high fire pressure switch before it is energized to confirm proper air flow.

Demand Satisfied:

1. When the demand for heat is satisfied the low operator switch will open, de-energizing relays R2, R2R, R8, R9, TD1, TD3, TD4, TD6, the FSM, and the pilot, main and safety solenoid valves. The pilot and main flames are extinguished.
2. The blower delay timer TD3 starts the 80 second post-purge timing. The blower(s) shut(s) off when TD3 times out.
3. The pump delay timer TD4 starts the post-purge timing. The pump(s) remain on for 0.1 to 10 minutes then shut(s) off when TD4 times out.

High Limit, Low Water Flow, Low Gas Pressure, High Gas Pressure, Power Venter Interlock Faults

1. Electrical power to the gas valves, blower(s) and power venter will be interrupted if any safety is tripped.
2. The manual reset high limit can be reset by depressing the reset button on the left jacket panel.

Low Air (Blocked Flue/Air Inlet)

- The pressure switches will monitor blower airflow.
- Air monitoring will begin at pre-purge. If a low air condition is present, power will not be supplied to the FSM. The blower(s) will remain on.

OPERATING INSTRUCTIONS

FOR YOUR SAFETY READ BEFORE OPERATING

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHE

A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.

Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement la veilleuse. Ne tentez pas d'allumer la veilleuse manuellement.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WARNING Propane gas may not always be detected by smell. Propane gas is heavier than air and can collect in low areas.

Propane gas can ignite or explode if an ignition source is present and result in death, serious injury and property damage!

FOR YOUR SAFETY

- Have only qualified licensed professionals install, service and maintain this appliance and your gas system in accordance with all applicable codes.
- Install a nationally listed combustible gas detector(s) in your home.
- If you suspect a leak:
  1. Have everyone leave the building immediately.
  2. Do not attempt to light any appliance.
  3. Do not touch any electrical or electronic switches in the building.
  4. Do not use any phone in the building.
  5. Call your gas supplier from a phone outside of the building.
  6. If you cannot reach your gas supplier call the fire department.

AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur; ne pas vous servirdes téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suives les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service de incendies.

C. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control that has been under water.

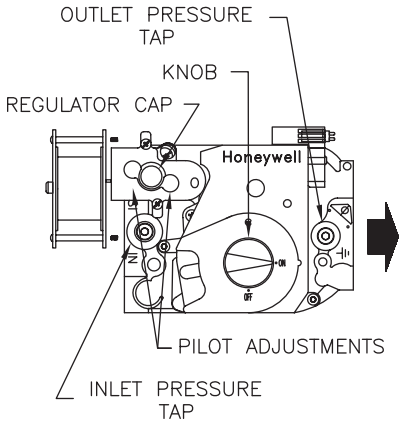
N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un tecnicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

CAUTION To prevent being burned, stand clear of the boiler during ignition and do not touch any hot metal parts.

Operating Instructions

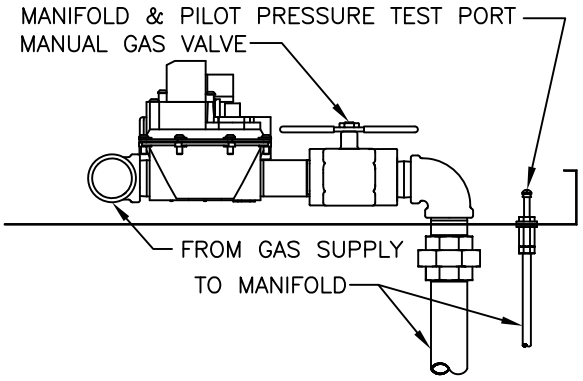
1. **STOP!** Read the safety information above. If, at any time, the appliance will not operate properly, follow the instructions "TO TURN OFF GAS TO APPLIANCE".
2. Set the operating control or thermostat to off or its lowest setting.
3. Turn off all electric power to the appliance.
4. Close the main manual gas shut-off valve, Figure 16.
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, **STOP!** Follow "B" in the safety information above (to the left) on this label. If you do not smell gas, go to the next step.
6. Remove the upper front jacket panel.
7. Turn the knob on the pilot valve to off, Figure 18.
8. Turn the knob on the main gas valve to off, 225 through 400 models, Figure 18. On 600 through 2300 models close the manual shutoff valve located in the control compartment, Figure 19.
9. Remove the plug(s) from the pilot and manifold pressure fitting(s), Figure 19.
10. Connect a manometer having a minimum capacity of **20 in**, *508 mm WC* to the pilot and manifold pressure fittings, Figure 19. Make sure the gas supply piping has been purged of air and all gas joints up to the gas valve have been thoroughly checked for leaks.
11. Remove plug(s) from the differential air pressure taps, Figure 17.
12. Connect both sides of a manometer to the pressure switch tee, Figure 17, going to one of the pressure switches.

Figure 18 Pilot valve (all models)
main valve (225 - 400 models)



13. Turn the knob on the pilot valve to on, Figure 18.
14. Turn on all electric power to the boiler and set the operating control or thermostat to the desired setting.
15. With the unit operating at high purge the differential air pressure should match those listed in Table 15. To adjust the differential air pressure see the "AIRFLOW ADJUSTMENT" instructions in the "CHECKING AND ADJUSTMENTS" section.

Figure 19 Manual valve & manifold pressure tap



16. The pilot should automatically light. Do <u>not</u> try to light the pilot by hand!
17. The pilot pressures should match those listed in Table 20. To adjust the pilot gas pressure see the "PILOT ADJUSTMENT" instructions in the "CHECKING AND ADJUSTMENTS" section.
18. Distinguish pilot.
19. Turn the knob on the main gas valve to on, 225 through 400 models, Figure 18. On 600 through 2300 models open the manual shutoff valve located in the control compartment, Figure 19.
20. Recycle boiler.
21. The manifold pressures should match those listed in Table 20. To adjust the manifold gas pressure see the "GAS PRESSURE ADJUSTMENT" instructions in the "CHECKING AND ADJUSTMENTS" section.
22. Replace the upper front jacket panel.
23. Check all safety switches for proper operation before placing boiler on-line.

Required Gas Pressure

Provide gas supply pressure at inlet to boiler gas train as follows:

	LP	Nat
Minimum (in WC)	**11**	**6**
Maximum (in WC)	**14**	**14**

Measure pressure when the boiler is firing at full rate. Low gas pressure could indicate undersized gas line or insufficient gas supply.

Static and operating gas pressure required at the gas valve inlet is between 6 in WC and 14 in WC for natural gas and 11 in WC and 14 in WC for propane. If the gas pressure is above this limit, a lock-up style regulator suitable for dead end service such as an Equimeter or Fisher must be installed to prevent increase (creep) of gas pressure when the units are not operating. This pressure regulator (supplied by others) may be installed at the service entrance to each unit or a "master" regulator sized to handle multiple units may be utilized. Consult local gas utility or regulator manufacturer for recommendations to meet specific job site requirements.

Table 20 Pilot & manifold pressures

	On/Off	
	inches WC	*mm WC*
Pilot - NG	**2.5 ± 0.3**	*63.5 ± 7.6*
Pilot - LP	**7.0 ± 2.0**	*177.0 ± 50.0*
	Low Fire	
	inches WC	*mm WC*
Manifold - NG	**1.4 ± 0.2**	*35.5 ± 5.0*
Manifold - LP	**4.0 ± 0.5**	*101.6 ± 12.7*
	High Fire	
	inches WC	*mm WC*
Manifold - NG	**2.5 ± 0.2**	*63.5 ± 5.0*
Manifold - LP	**9.3 ± 0.3**	*236.2 ± 7.6*

Table 21 Combustion readings

	Natural Fuel	Propane Fuel
CO_2 %	7.0 - 7.5 (low)	8.2 - 8.8 (low)
	7.8 - 8.5 (high)	9.2 - 9.9 (high)
O_2 %	8.3 - 7.6 (low)	8.3 - 7.6 (low)
	7.0 - 5.8 (high)	7.0 - 5.8 (high)

Instructions De Mise En Marche

1. ARRÊTEZ! Lisez les instructions de sécurité sur la portion supérieure de cette étiquette.
2. Réglez le thermostat à la température la plus basse.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement la veilleuse. Ne tentez pas d'allumer la veilleuse manuellement.
5. Fermer la vanne manuelle d'arrêt d'alimintation de gaz.
6. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz. Si vous sentez une odeur de gaz, ARRÊTEZ! Passez à l'étape B des instructions de sécurité sur la portion supérieure de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
7. Ouver la vanne manuelle d'arrêt d'alimintation de gaz.
8. Mettez l'appareil sous tension.
9. Réglez le thermostat à la température désirée.
10. Si l'appareil ne se met pas en marche, suivez les instructions intitulées couper l'admission de gaz de l'appareil et appelez un technicien qualifié ou le fournisseur de gaz.

To Turn Off Gas To Appliance

1. Set the operating control or thermostat to its lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Close the manual main valves.

COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Réglez le thermostat à la température la plus basse.
2. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
3. Fermer la vanne manuelle d'arrêt d'alimintation de gaz.

CHECKING & ADJUSTMENTS

1. With the burners in operation, close the manual shutoff valve in the gas supply line. As soon as the main burner flames go out, open the manual shutoff valve. A normal ignition sequence should take place. If the burners fail to light, the gas valves will close and the system will go into a 5-minute lock out period. The flame sense module will then make a second ignition attempt. If the unit won't light ensure that the gas piping is fully purged of air. Inspect the ignition system and ensure that it is operating properly.
2. To test the ignition safety shutoff device, close the manual shutoff valve in the gas supply line. Within 5 seconds of main burner flame extinction, the main gas valve solenoid should close with an audible noise. After 10 seconds the module should lockout and the trial for ignition end. After 5 minutes a second trial for ignition should occur. Open the manual shutoff valve in the gas supply line and reset the ignition control system. A normal ignition sequence should take place.
3. With the burners in operation, interrupt the power to the control circuit by turning down the operator or thermostat. The boiler/water heater should shut down. Reset the operating control or thermostat. A normal ignition sequence should follow.

Input Rate, Natural Gas

Gas appliances are rated based on sea level operation with no adjustment required at elevations up to **5000 ft**, *1524 m*. At elevations above **5000 ft**, *1524 m*, input ratings should be reduced by 4% for each additional **1000 ft**, *305 m*.

Check the input rate as follows:

1. Turn off all other gas appliances that use the same gas meter as the boiler/water heater.
2. Call your gas supplier and ask for the heating value of the gas.
3. Connect a flue gas analyzer to the vent pipe.
4. Start the boiler/water heater and let it run for 15 minutes.
5. Using the gas meter and a stopwatch, clock the time that it takes to burn **10 ft^3**, *0.28 m^3* of gas and divide this time by 10.
6. Insert the heating value and the time, in seconds, into the formula below.
7. Input = (heating value, Btu/hr)(3600)/(time, seconds)
8. If the computed rate deviates by more than 5% from the rated input value of the unit adjust the manifold pressure accordingly. DO NOT adjust the manifold pressure by more than 5%. If a proper rate cannot be maintained without adjusting the manifold pressure beyond the 5% limit, the main burner orifices must be replaced. If the input rate is too low, go to the next lager size of main burner orifices. If the input rate is too high, go to the next smaller size.

CAUTION Never increase the input of the boiler/water heater above that for which it is rated. Doing so can cause premature failure of the unit!

Pilot Adjustment

The pilot burner is actually an isolated main burner that's controlled by a separate pilot valve. Pilot pressure settings are as shown in Table 20. These pressures are measured at the pilot pressure valve, see Figure 19. Tables 13 and 14 above list the firing mode that is associated with each stage.

To view the pilot without main burner operation, take the following steps:

For L225-L400:

1. Remove the upper front jacket panel.
2. Turn off main burner gas flow by turning the main burner gas valve knob to the off position, Figure 18.
3. Observe the pilot flame through one of the observation ports located at the left and right ends of the unit.

For L600-L2300:

1. Remove the upper front jacket panel.
2. Turn off main burner gas flow by turning the manual gas valve(s) in the control compartment to the off position, see Figure 19.
3. Observe the pilot flame through one of the observation ports located at the left and right ends of the unit.

Pilot pressures will be set at the factory. However, if it is necessary to adjust the pilot pressure to match those in Table 20, take the following steps:

1. Remove the upper front jacket panel.
2. Remove the 1/8 in plug from the pilot pressure test port and connect a **20 in**, *508 mm* WC manometer to it, see Figure 18.
3. Remove the gas pressure regulator cap from the pilot valve. See Figure 18 for the location of the regulator and cap.
4. Use a 3/32 hex wrench to turn the pressure regulator adjustment screw clockwise to increase the pilot pressure and counter clockwise to decrease it.
5. Replace the pressure regulator adjustment screw cap.

Gas Pressure Adjustment

CAUTION The maximum inlet gas pressure listed on the rating plate must not be exceeded or damage to the boiler/water heater may occur voiding the warranty!

The minimum supply pressure listed on the rating plate is for input adjustment.

The manifold pressures should match those listed in Table 20. Pressures should not vary outside these ranges. Each gas valve pressure regulator has been preset at the factory. If neccessary, adjust the gas pressures to achieve the combustion results show in Table 21.

If adjustments are necessary the following steps must be followed:

1. Remove the 1/8 in plug from the manifold pressure tap valve. Connect **20 in**, *508 mm* WC manometers to it, see Figure 19.
2. Remove the regulator adjustment screw cap from the main gas valve.
3. Rotate the regulator adjustment screw clockwise to increase the manifold pressure, counter clockwise to decrease it.
4. Replace the regulator adjustment screw cap and manual shut off valve pressure tap plug.

CAUTION Never force the regulator adjustment screw beyond the stop limits or damage to the regulator will occur!

PROPANE GAS: Optimum results are obtained when the boiler/water heater is operated with the manifold pressure(s) set per Table 20. If the manifold pressure is off by more than 5% adjust it according to steps 1 through 4 above.

Airflow Adjustment

1. Remove the upper front jacket panel.
2. Connect both sides of a manometer to the pressure switch tee, Figure 17, going to one of the pressure switches.
3. With the unit operating at high fire the differential pressure should match those listed in Table 15. Do not change air pressure in lower stages.

CONTROL DESCRIPTION

Boiler Thermostat

If a thermostat is to be used to control the boiler always follow the instructions included with the thermostat. Proper location of the thermostat will ensure efficient trouble-free operation of the boiler. Mount the thermostat to an inside wall at a height approximately five feet above the floor.

Avoid placing the thermostat in areas that will not provide an accurate measurement of the room temperature. Locating the thermostat behind a door, in an alcove, close to a source of thermal radiation or in a drafty area will cause poor or sporadic heating.

For a thermostat that employs an adjustable heat anticipator, adjust the anticipator to match the current measured in the thermostat circuit. An increased anticipator setting may be necessary if the unit cycles frequently. If the room temperature over-shoots the thermostat setting, reduce the anticipator setting.

Operating Control

The preferred control setting for potable hot water is **130°F**, *54°C*. The operating control should be set to the lowest setting that will satisfy the consumer's needs.

WARNING Setting the thermostat or operation control too high can result in scalding resulting in severe personal injury!

High Limit (Aquastat)

The high limit is located in the top control area of the boiler/water heater. A remote capillary bulb is run to a well on the outlet side of the supply header. The high limit can be reset by depressing the reset button on the left jacket panel.

The water heater high limit should be set a minimum of **20°F,** *11°C* higher than the operating control. Refer to the HOT WATER SUPPLY section for the proper supply water temperature.

Flow Switch

A flow switch is provided in the water outlet piping to prevent the boiler/water heater from firing without adequate water flow through the heat exchanger.

Low Water Cutoff

If the boiler is to be installed above radiation or if required by other codes or regulations, install a low water cutoff in appropriate piping. Wire the switch and any external controls in series to the "Interlock" contacts in the control box, see the wiring diagrams included with the unit for details. Ensure that the low water cutoff device(s) will function properly.

Flame Sense Module

The flame sense module is located in the control box. It is an intermittent pilot control device that controls the pilot gas flow, spark energy to ignite the pilot gas and the main valve(s) once pilot ignition has been proven.

Two flame failure alarm terminals are provided on the flame sense module. For CSD-1 these terminals are utilized to shut the unit down in case of flame failure. The two terminals are connected to a lockout control module located in the control box. This lockout control module contains a magnetic latch relay that requires manual reset when de-energized. To reset after flame failure, push and release the momentary contact switch located on the left jacket panel.

Relay Board

The relay board is located in the control panel. It provides sequencing of the gas valves and blower(s) based on the staging controller's input. It also provides the following time delays for proper unit operation:

- A 10 second prepurge when stage 1 is energized.
- A 30 second pressure switch sequencing delay when the blowers switch from low fire to high fire. The delay enables the blower to come up to speed before the high pressure side of the pressure switch confirms proper air flow.

These time delays are set within the separate time delay board connected to the relay board.

Gas Pressure Switch

Optional low and/or high-pressure gas pressure switches will shut down the 24V circuit if excessively high or low gas pressure exists in the gas train or supply piping.

MAINTENANCE

WARNING Disconnect electrical power and close the manual gas shut off valve before performing maintenance or severe personal injury may result!

WARNING Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, exposure to hazardous materials or loss of life. Installation and service must be performed by a qualified installer, service agency or the gas supplier who must read and follow the supplied instructions before installing, servicing or removing this boiler. This boiler contains crystalline silica materials that have been identified as carcinogenic or possibly carcinogenic to humans when inhaled.

AVERTISSEMENT: Une installation, un réglage, une modification, une réparation ou un entretien non comforme aux normes peut entraîner des dommages matériels, des blessures, exposition à des matières dangereuses ou la mort. L'installation et l'entretien doivent être effectués par un installateur ou un service d'entretien qualifié ou le fournisseur de gaz qui doivent avoir lu les instructions fournies avant de faire l'installation, l'entretien ou l'enlèvement de la chaudière et les respecter, Cette chaudière contient des matériaux qui ont été identifiés comme étant cancérogènes ou pouvant l' être.

CAUTION Servicing, inspection and adjustment must be done by a trained technician in accordance with all applicable local and national codes. Improper servicing or adjustment can damage the boiler/water heater!

WARNING The ceramic combustion chamber contains crystalline silica. Wear a tightly fitted dust mask when removing the burners or heat exchanger to prevent inhalation of airborne fibers. Crystalline silica fibers have been identified as carcinogenic, or possibly carcinogenic when inhaled.

The boiler/water heater should be cleaned and inspected once a year, before each heating season. Make sure that the burner and ignition components are free from dust, soot, dirt, corrosion or other deposits that would impair the boiler/water heater 's performance. Refer to page 36 for component identification.

Burner Inspection And Removal - Figure 20

1. Close the manual shutoff valves in the gas supply lines and turn off electrical power to the boiler/water heater.
2. Remove the front jacket panels.
3. Disconnect the manifold gas piping at the ground joint union(s). Also disconnect the pressure sensing lines, pilot tubing and ignition and sensing leads.
4. Remove the manifold(s).
5. Remove the burner(s) from the lower front combustion chamber panel.
6. Inspect the burners for damage or signs of deterioration. Use a brush or compressed air to remove any debris from the burner ports.
7. DO NOT install a damaged or badly corroded burner replace it.
8. Install the burner(s) making sure that the burner gasket is not torn or deteriorated. If it is replace it.
9. Reassemble the unit following the removal steps in reverse order.

Heat Exchanger Inspection - Figure 20

1. Close the manual shutoff valve in the gas supply line and turn off electrical power to the boiler/water heater.
2. Remove the jacket front panels.
3. Disconnect the gas piping at the ground joint union(s). Also disconnect the pressure sensing lines, pilot tubing and ignition and sensing leads.
4. Remove the 1/4 in nuts and washers holding the upper combustion chamber front panel in place and carefully remove it.
5. Inspect the inside and outside of the heat exchanger for signs of damage, sooting or corrosion.
6. The outside surfaces of the copper tubes should be free of any soot deposits. A slight black smudge is normal with some types of gases. Black soot indicates poor combustion. Green deposits indicate condensation due to low return water temperatures. In either case the heat exchanger must be cleaned thoroughly and the problem resolved before the boiler/water heater is returned to service
7. If there are no signs of damage, sooting or corrosion reassemble the unit following the previous steps in reverse order.
8. A badly corroded or damaged heat exchanger must be replaced, see the **Heat Exchanger Removal** section.

Heat Exchanger Removal, Cleaning & Replacement - See Figure 20

1. Close the shut off valves in the inlet and outlet piping. On heating systems close the system fill valve and relieve the system pressure from the boiler by carefully lifting the relief valve or opening the drain valve.
2. Drain the boiler/water heater and disconnect it from the system piping.
3. Remove the inlet/outlet and return headers.
4. Remove the jacket front panels.
5. Loosen, 4 turns, but **don't remove** the 6 screws, (3 on each side) holding the heat exchanger upper rails in place, Figure 21.
6. Disconnect the gas piping at the ground joint unions. Also disconnect the pressure sensing lines, pilot tubing and ignition and sensing leads.
7. Remove the upper partition panel, 1050 through 2300 models.
8. Remove the 1/4 in nuts and washers holding the upper combustion chamber front panel in place and carefully remove it.
9. Carefully slide the heat exchanger out of the unit.
10. Remove the "V" baffle straps and "V" baffles.
11. Thoroughly inspect the heat exchanger for signs of damage. If there is no damage, clean the heat exchanger with water from a high-pressure hose. Use a soft bristle brush if necessary.

CAUTION Never clean the heat exchanger while it's in the boiler/water heater or the combustion chamber will be destroyed!

12. Sagging or distorted heat exchanger tubes are an indication of low water flow through the system. A leaking or otherwise damaged heat exchanger must be replaced and the condition that caused the damage resolved before the boiler/water heater is returned to service.
13. If the heat exchanger isn't damaged rewire the heat exchanger baffles in place and slide the heat exchanger back into the unit.
14. Reinstall all of the other components in the reverse order of their removal.
15. The torque values for the bolts that secure the removable headers are 17-20 ft lbs. Once bolts have been started and secured the tightening sequence is as follows:
    1) Middle Top
    2) Middle Botom
    3) Right Top
    4) Left Bottom
    5) Left Top
    6) RightBottom

Figure 20 Burner and heat exchanger servicing

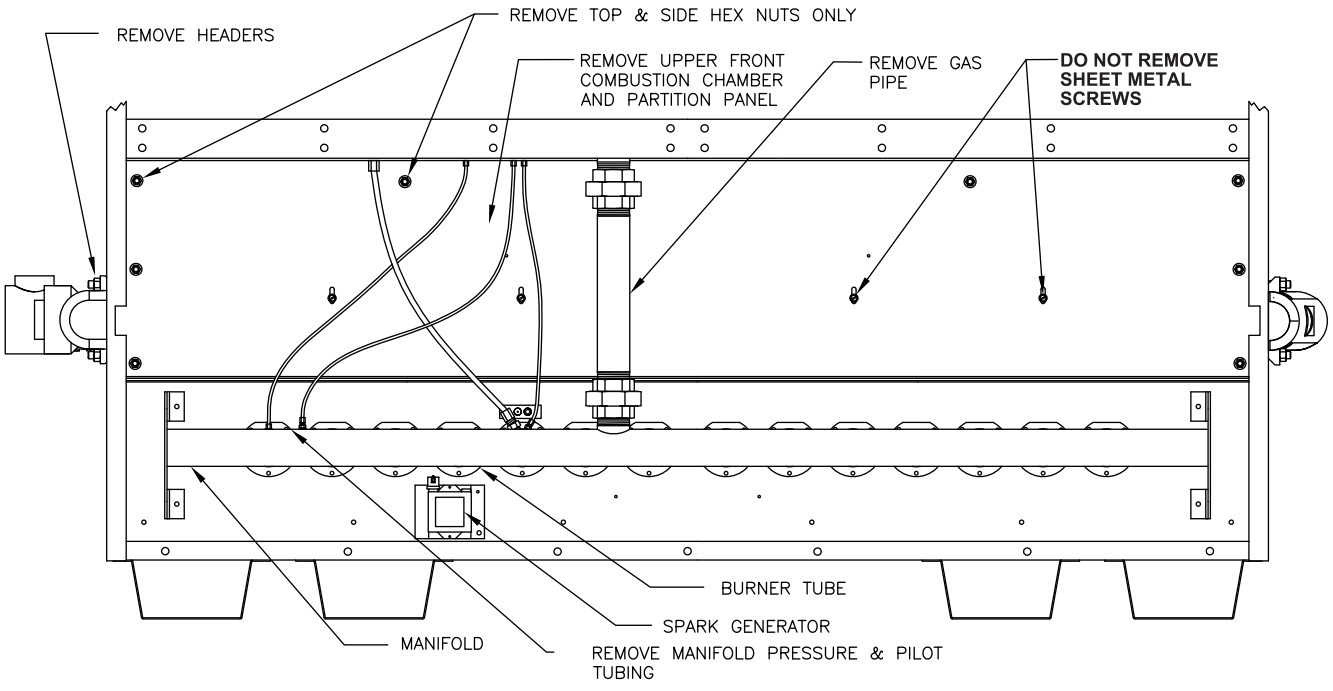
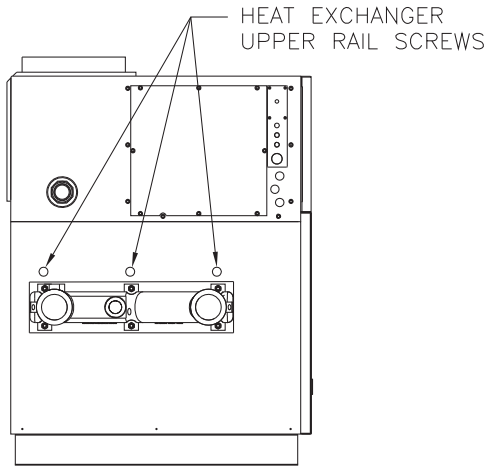

REMOVE HEADERS
REMOVE TOP & SIDE HEX NUTS ONLY
REMOVE UPPER FRONT COMBUSTION CHAMBER AND PARTITION PANEL
REMOVE GAS PIPE
DO NOT REMOVE SHEET METAL SCREWS
BURNER TUBE
SPARK GENERATOR
MANIFOLD
REMOVE MANIFOLD PRESSURE & PILOT TUBING

Figure 21 Heat exchanger upper rail screws



Vent System

Thoroughly inspect the vent system for any signs of blockage, corrosion or leakage. Immediately replace any unsound vent system piping.

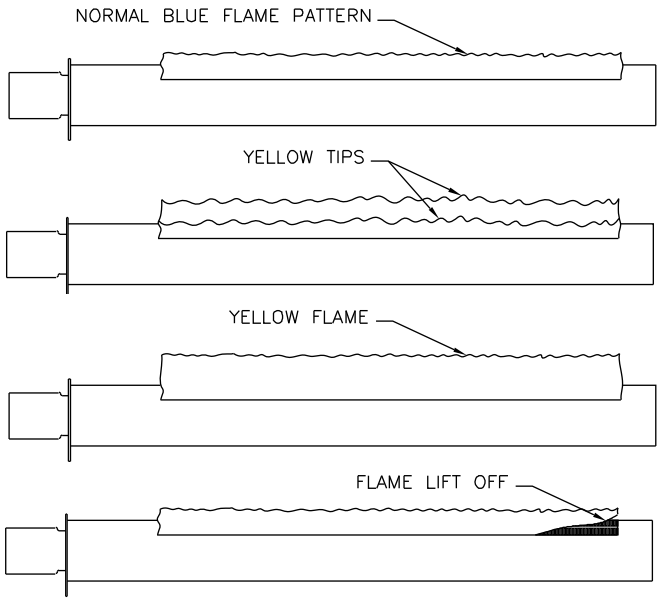
Controls

Use the "BOILER/WATER HEATER OPERATION" and "CHECKING AND ADJUSTMENTS" sections of this manual for reference.

1. Check the thermostat or operating controls for proper operation.
2. A float type low water cutoff device must be flushed out per the manufacturers' instructions. The probe on a probe low water cut off must be cleaned and inspected per the manufacturers' instructions. Ensure that the low water cutoffs operate properly. If not, replace them.
3. The flow switch contacts must be open when water flow is not present.
4. The relief valve should not weep or discharge water at normal system pressure. If it does contact a qualified service technician to have it inspected. NEVER try to clean or repair the relief valve! If the valve fails to operate properly, have it replaced!
5. The aquastat high limit controls the maximum water temperature in the boiler. It should be set at least **20°F**, *11°C* above the operater setpoint. If the water temperature reaches the set temperature before the demand for heat has been met, the aquastat high limit should shut the boiler off. The water temperature should never exceed the maximum set point of **240°F**, *116°C*. The aquastat high limit cannot be repaired. If it fails to function properly replace it.
6. Visually check the pilot and main burner flames to ensure proper operation, see Figure 22.

WARNING A yellow, floating flame indicates a lack of combustion air. A lifting flame indicates too much combustion air. Do not operate the boiler/water heater until the problem is solved or severe personal injury or death may occur!

Figure 22 Pilot & main burner flame



TROUBLE-SHOOTING

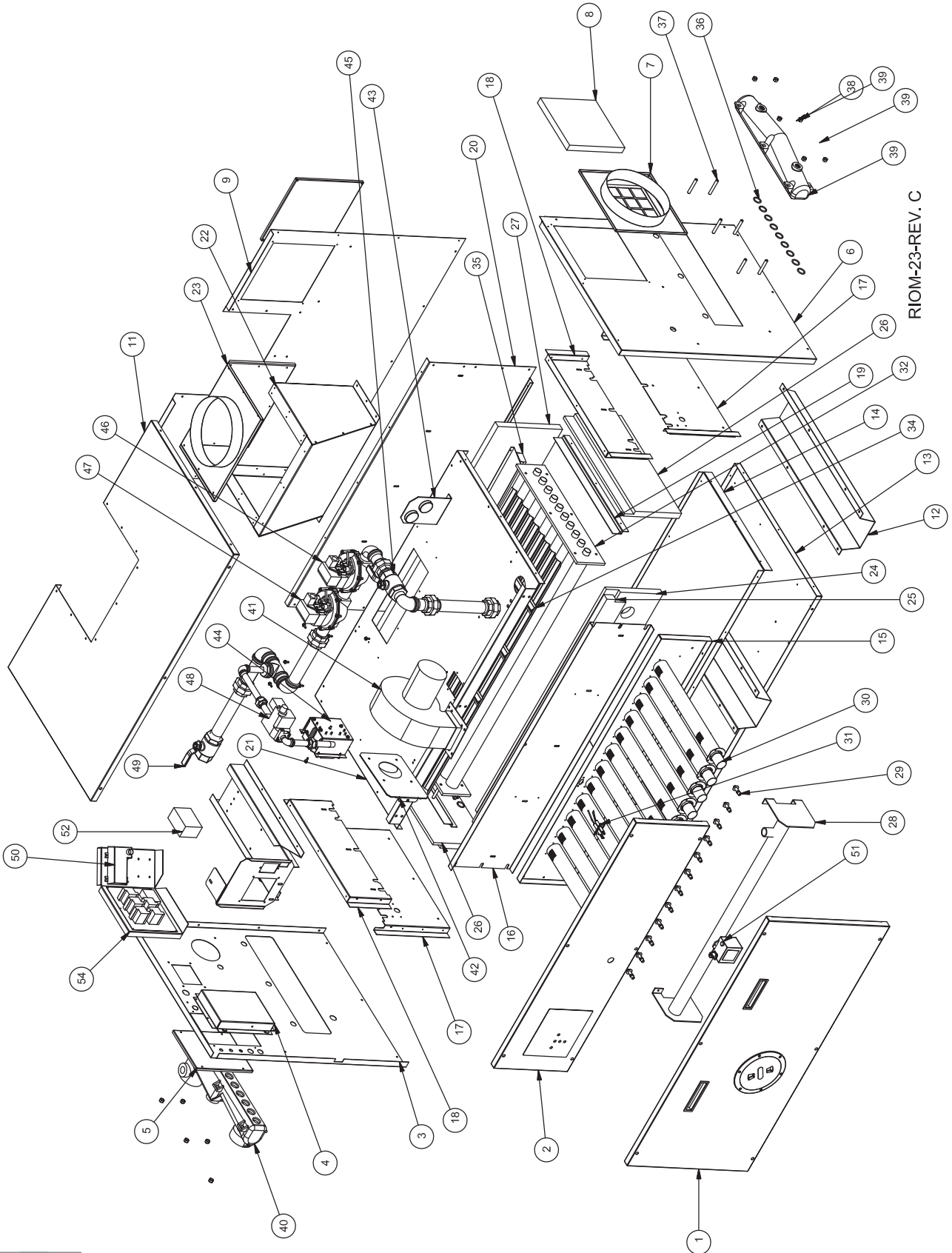
	SYMPTOM	CHECK	ACTION
1	No Power To Control Circiut	1. Power not connected	1. Wire unit to line voltage
		2. External circuit breaker open	2. Reset breaker
		3. Transformer circuit breaker open	3. Reset breaker
2	No Action On Call For Heat	1. Primary limit or other control/interlock open	1. Reset limit or control or resolve problem as applicable If not resolved, check wiring and condition of limit
		2. Low water cutoff open	2. Check circulating pump Check pump contact in control box Check LWCO wiring and condition
3	No Power To Pump	1. Pump contact not wired	1. Wire pump contact in control box
		2. Pump malfunctioning	2. Replace pump
		3. Defective pump timer TD4	3. Replace pump timer TD4
4	No Power to Optional Power Venter	1. Power venter not wired to external power	1. Wire power venter as shown in connection diagram
		2. Power venter fault	2. Replace power venter
5	Power Venter On, No Action From Unit	1. Power venter interlock not wired	1. Wire power venter interlock as shown in connection diagram
6	No Power To Blower(s)	1. Blower(s) not plugged in	1. Plug in blower(s)
		2. Defective blower timer TD3	2. Replace blower timer TD3
		3. Blower(s) malfunctioning	3. Replace blower(s)
7	Unit Does Not Spark	1. Incorrect spark gap or shorted ignitor lead	1. Properly adjust ignitor gap or correct short
		2. Bad ground on flame sense module	2. Check ground connections, adjust as necessary
		3. Defective flame sense module	3. Replace flame sense module
		4. Low air (blocked flue/inlet) condition	4. If condition exists, check inlet, flue, & chimney for blockage Check combustion air/ventilation opening in space Check inlet air filter, clean/replace as necessary
		5. Spark generator fault	5. Check spark generator wiring
		6. Defective air purge timer TD1	6. Replace timer TD1
8	Unit Sparks But Will Not Fire	1. Low gas pressure	1. Check gas supply pressure during inition trial, adjust as necessary
		2. Pilot valve manual knob closed	2. Open pilot valve manual knob
		3. Pilot valve not wired	3. Connect pilot valve wires
		4. Low pilot pressure	4. Check pilot pressure, adjust as necessary
		5. Pilot valve malfunctioning	5. Replace pilot valve

TROUBLE-SHOOTING

	SYMPTOM	CHECK	ACTION
9	Pilot Lights But Main Burners Will Not Fire	1. Bad flame sense lead from ignitor to flame sense module	1. Check sense lead & ground connections, adjust as necessary
		2. Defective flame sense module	2. Replace flame sense module
		3. Manual valve(s) in air plenum closed	3. Remove upper front jacket panel, open manual valve(s)
		4. Main valves(s) not wired	4. Wire main valve(s)
		5. Low manifold pressure	5. Check manifold pressure during ignition trial, adjust as necessary
		6. Main valve(s) malfunctioning	6. Replace main valve(s)
10	Insufficient Heating	1. Operating control set too low	1. Increase control temperature setting
11	Unit Consistently Shuts Down On High Limit	1. High limit set to low	1. Increase high limit setting
12	Bad Combustion (High CO, Yellow Flames)	1. Insufficient air	1. Check CO & CO_2, adjust blower inlet damper(s) to increase airflow Check for plenum air leakage from lower front jacket panel seams, repair as necessary
		2. Dirty inlet air filter	2. Remove, inspect and clean inlet air filter as necessary
		3. Too much air	3. Check CO & CO_2, adjust blower inlet damper(s) to decrease airflow
13	Gas Flow Shuts Down During Operation (Blowers Remain On)	1. Low air (blocked flue/inlet) condition	1. If condition exists, check inlet, flue, chimney for blockage Check combustion air/ventilation openings in space Check inlet air filter, clean/replace as necessary Check pressure switch for correct setting

REPAIR PARTS

Figure 23 Exploded view



REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
1	Jacket Lower Front Panel	70-2716	1	1									
		70-2717			1								
		70-2718				1							
		70-2719					1						
		70-2721						1					
		70-2722							1	1			
		70-2723									1		
		70-2724										1	
		70-2725											1
	Jacket Lower Front Panel (SS)	70-2716.1	1	1									
		70-2717.1			1								
		70-2718.1				1							
		70-2719.1					1						
		70-2721.1						1					
		70-2722.1							1	1			
		70-2723.1									1		
		70-2724.1										1	
		70-2725.1											1
	Handle	20-0050	1	1	1	1	1	1	1	1	1	1	1
	Deckplate	20-0062					1	1	1	1	1	1	1
2	Jacket Upper Front Panel	70-3101	1	1									
		70-3102			1								
		70-3103				1							
		70-3104					1						
		70-3106						1					
		70-3107							1	1			
		70-3108									1		
		70-3109										1	
		70-3110											1
	Jacket Upper Front Panel (SS)	70-3101.1	1	1									
		70-3102.1			1								
		70-3103.1				1							
		70-3104.1					1						
		70-3106.1						1					
		70-3107.1							1	1			
		70-3108.1									1		
		70-3109.1										1	
		70-3110.1											1
3	Jacket Left Panel	03-2155	1	1	1	1	1	1	1				
		03-1822								1	1	1	1
	Jacket Left Panel (SS)	03-2155.1	1	1	1	1	1	1	1				
		03-1822.1								1	1	1	1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
4	Junction Box Assembly	70-3113	1	1	1								
	Junction Box Assembly	70-3113.1				1	1	1	1	1	1	1	1
5	Junction Box Cover	03-2036	1	1	1	1	1	1	1	1	1	1	1
6	Jacket Right Panel	03-2158	1	1	1	1	1						
		03-2159						1	1				
		03-1825								1	1	1	1
	Jacket Right Panel (SS)	03-2158.1	1	1	1	1	1						
		03-2159.1						1	1				
		03-1825.1								1	1	1	1
7	Combustion Air Inlet Assembly (Indoor)	70-2744	1	1	1								
		70-2746				1	1						
		70-2748						1					
		70-2749							1	1	1	1	1
	Combustion Air Inlet Assembly (Outdoor)	70-2820	1	1	1								
		70-2821				1	1						
		70-2822						1					
		70-2823							1	1	1	1	1
8	Filter (Indoor)	09-0488	1	1	1								
		09-0489				1	1						
		09-0497						1					
		09-0498							1	1	1	1	1
	Filter (Outdoor)	09-0490	1	1	1	1	1						
		09-0491						1	1	1	1	1	1
9	Jacket Rear Panel	03-1811	1	1									
		03-1812			1								
		03-1813				1							
		03-1814					1						
		03-1816						1					
		03-1817							1	1			
		03-1818									1		
		03-1819										1	
		03-1820											1
	Jacket Rear Panel (SS)	03-1811.1	1	1									
		03-1812.1			1								
		03-1813.1				1							
		03-1814.1					1						
		03-1816.1						1					
		03-1817.1							1	1			
		03-1818.1									1		
		03-1819.1										1	
		03-1820.1											1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
11	Jacket Top Panel	03-1801	1	1									
		03-1802			1								
		03-1803				1							
		03-1804					1						
		03-1806						1					
		03-1807							1	1			
		03-1808									1		
		03-1809										1	
		03-1810											1
	Jacket Top Panel (SS)	03-1801.1	1	1									
		03-1802.1			1								
		03-1803.1				1							
		03-1804.1					1						
		03-1806.1						1					
		03-1807.1							1	1			
		03-1808.1									1		
		03-1809.1										1	
		03-1810.1											1
	Jacket Top Panel (Outdoor)	70-2969	1	1									
		70-2970			1								
		70-2971				1							
		70-2972					1						
		70-2974						1					
		70-2975							1	1			
		70-2976									1		
		70-2977										1	
		70-2978											1
NS	Outdoor Hood Assembly	70-2951	1	1									
		70-2952			1								
		70-2953				1							
		70-2954					1						
		70-2956						1					
		70-2957							1	1	1		
		70-2958										1	1
12	Base Panel Legs	03-1862	2	2	2	2	2	4	4	4	4	4	4

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
13	Jacket Base Panel	03-1847	1	1									
		03-1848			1								
		03-1849				1							
		03-1850					1						
		03-1852						1					
		03-1853							1	1			
		03-1854									1		
		03-1855										1	
		03-1856											1
14	Combustion Chamber Base Panel	03-1974	1	1									
		03-1975			1								
		03-1976				1							
		03-1977					1						
		03-1979						1					
		03-1980							1	1			
		03-1981									1		
		03-1982										1	
		03-1983											1
	Cerablanket Insulation	05-0103	3	3	4	4	6	8	8	10	10	12	12
	Manning Glass Insulation (per square foot)	05-0104	3	3	4	4	6	8	8	10	10	12	12
15	Combustion Chamber Lower Front Panel	03-2170	1										
		03-1962		1									
		03-1963			1								
		03-1964				1							
		03-1965					1						
		03-1967						1					
		03-2171							1				
		03-1968								1			
		03-1969									1		
		03-1970										1	
		03-1971											1
16	Combustion Chamber Upper Front Panel	70-2775	1	1									
		70-2776			1								
		70-2777				1							
		70-2778					1						
		70-2780						1					
		70-2781							1	1			
		70-2782									1		
		70-2783										1	
		70-2784											1
17	Comb Chamber Lower Left Side Panel	70-2772	1	1	1	1	1	1	1	1	1	1	1
	Comb Chamber Lower Right Side Panel	70-2773	1	1	1	1	1	1	1	1	1	1	1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
18	Comb Chamber Upper Left Side Panel	70-2770	1	1	1	1	1	1	1	1	1	1	1
	Comb Chamber Upper Right Side Panel	70-2771	1	1	1	1	1	1	1	1	1	1	1
19	Heat Exchanger Guide Rail	03-1938	4	4	4	4	4	4	4	4	4	4	4
20	Combustion Chamber Rear Panel	03-1904	1	1									
		03-1905			1								
		03-1906				1							
		03-1907					1						
		03-1909						1					
		03-1910							1	1			
		03-1911									1		
		03-1912										1	
		03-1913											1
	Manning Glass Insulation (per square foot)	05-0104	2	2	3	3	4	5	6	7	7	8	9
21	Combustion Chamber Top Panel	70-2750	1	1									
		70-2751			1								
		70-2752				1							
		70-2753					1						
		70-2755						1					
		70-2756							1	1			
		70-2757									1		
		70-2758										1	
		70-2759											1
	Manning Glass Insulation (per square foot)	05-0104	4	4	5	6	7	10	12	13	13	17	18
22	Flue Box Wrapper Assembly	70-2798	1	1									
		70-2799			1								
		70-2800				1							
		70-2801					1						
		70-2803						1					
		70-2804							1	1	1		
		70-2805										1	1
23	Flue Outlet Assembly	70-3117.1	1										
		70-2736.1		1									
		70-2737.1			1								
		70-2738.1				1							
		70-2739.1					1						
		70-2741.1						1					
		70-2742.1							1	1			
		70-2742.1									1		
		70-2743.1										1	1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
24, 25, 27	Tile Kit	05-0212	1										
		05-0202		1									
		05-0203			1								
		05-0204				1							
		05-0205					1						
		05-0207						1					
		05-0208K							1				
		05-0208								1			
		05-0209									1		
		05-0210K										1	
		05-0211											1
26	End Refractory Panel, Right	05-0058	1	1	1	1	1	1	1	1	1	1	1
	End Refractory Panel, Left	05-0107	1	1	1	1	1	1	1	1	1	1	1
28	Manifold	10-0470	1										
		10-0465		1									
		10-0466			1								
		10-0467				1							
		10-0468					1						
		70-3087						1					
		70-3088							1				
		70-3089								1			
		70-3090									1		
		70-3091										1	
		70-3092											1
29	Main Orifice, NG	10-0087	2	3		7	9	13	15				
	Main Orifice, NG	10-0130								17	19	23	27
	Main Orifice, LP	10-0088	2	3		7	9	13	15	17	19	23	27
	Main Orifice, NG	10-0115			5								
	Main Orifice, LP	10-0116			5								
NS	Pilot Orifice, NG	10-0089	1	1		1	1	1	1				
	Pilot Orifice, NG	10-0132								1	1	1	1
	Pilot Orifice, LP	10-0090	1	1		1	1	1	1	1	1	1	1
	Pilot Orifice, NG	10-0093			1								
	Pilot Orifice, LP	10-0120			1								
30	Burner Tube	10-0275	2	3	5	7	9	13	15	17	19	23	27
	Burner Tube w/hole for Pressure Switch	70-2898	1	1	1	1	1	1	1	1	1	1	1
	Pilot Tube Assembly (tubing and fittings)	70-2896	1	1	1	1	1	1	1	1	1	1	1
NS	Burner Gasket	06-0020	3	4	6	8	10	14	16	18	20	24	28

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
NS	Burner Support Rail	03-2090	1	1									
		03-2091			1								
		03-2092				1							
		03-2093					1						
		03-2095						1					
		03-2096							1				
		03-2097								1	1		
		03-2098										1	
		03-2099											1
31	Spark Ignitor (*prior to 0205 - must order cable 44-0056)	16-0327*	1	1	1	1	1	1	1	1	1	1	1
NS	Ignition Cable Assembly	44-0056	1	1	1	1	1	1	1	1	1	1	1
NS	Heat Exchanger Assembly (Copper) (Cast Iron Headers)	70-3001	1	1									
		70-3002			1								
		70-3003				1							
		70-3004					1						
		70-3006						1					
		70-3007							1				
		70-2832								1			
		70-2833									1		
		70-2834										1	
		70-2835											1
	Heat Exchanger Assembly (Copper) (Bronze Headers)	70-3023	1	1									
		70-3024			1								
		70-3025				1							
		70-3026					1						
		70-3028						1					
		70-3029							1				
		70-2852								1			
		70-2853									1		
		70-2854										1	
		70-2855											1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
NS	Heat Exchanger Assembly (Cupronickel)	70-3012	1	1									
	(Cast Iron Headers)	70-3013			1								
		70-3014				1							
		70-3015					1						
		70-3017						1					
		70-3018							1				
		70-2842								1			
		70-2843									1		
		70-2844										1	
		70-2845											1
	Heat Exchanger Assembly (Cupronickel)	70-3034	1	1									
	(Bronze Headers)	70-3035			1								
		70-3036				1							
		70-3037					1						
		70-3039						1					
		70-3040							1				
		70-2862								1			
		70-2863									1		
		70-2864										1	
		70-2865											1
32	Tube Bundle (Copper)	70-3053	1	1									
		70-3054			1								
		70-3055				1							
		70-3056					1						
		70-3058						1					
		70-3059							1				
		70-2907								1			
		70-2908									1		
		70-2909										1	
		70-2910											1
	Tube Bundle (Cupronickel)	70-3064	1	1									
		70-3065			1								
		70-3066				1							
		70-3067					1						
		70-3069						1					
		70-3070							1				
		70-2917								1			
		70-2918									1		
		70-2919										1	
		70-2920											1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
34	V Baffle Hold-Down	03-2021	2	3	3	3	4	4	5	5	8	8	8
NS	Heat Exchanger Support Channel	03-2022									1		
		03-2023										1	
		03-2024											1
35	Tube Replacement Assembly	70-3080	2	2									
		70-3081			2								
		70-3082				2							
		70-3083					2						
		70-3085						2					
		70-3086							2				
36	O Ring, Inlet/Outlet & Return Headers	06-0001	16	16	16	16	16	16	16	20	20	20	20
37	Stud, Inlet/Outlet & Return Headers	57-0220	12	12	12	12	12	12	12	12	12	12	12
38	Nut, Inlet/Outlet & Return Headers	57-0492	12	12	12	12	12	12	12	12	12	12	12
39	Return Header, Bronze	01-0011S	1	1	1								
		01-0004S				1	1	1	1				
		01-0018S								1	1	1	1
	Return Header, Cast Iron	01-0009S	1	1	1								
		01-0002S				1	1	1	1				
		01-0023S								1	1	1	1
40	Inlet/Outlet Header, Bronze	01-0010S	1	1	1								
		01-0003S				1	1	1	1				
		01-0019S								1	1	1	1
	Inlet/Outlet Header, Cast Iron	01-0008S	1	1	1								
		01-0001S				1	1	1	1				
		01-0022S								1	1	1	1
41	Blower, Fasco 7062	12-0013	1	1	1	1							1
	Blower, Fasco 7083	12-0014					1	2	2	2	2	2	2
42	Combustion Air Damper Assembly	70-2818	1	1	1	1							
		70-2819					1	2	2	2	2	2	2
43	Low Pressure Switch (.30 WC)	14-0059				1	1						
	Low Pressure Switch (.42 WC)	11-0417						1	1			1	
	Low Pressure Switch (.58 WC)	14-0058								1	1		1
	High Pressure Switch (.58 WC)	14-0058	1	1	1								
	High Pressure Switch (.80 WC)	14-0061				1	1	1	1	1	1	1	1
44	High Limit (LB)	14-0009	1	1	1	1	1	1	1	1	1	1	1
	High Limit (LW)	14-0008	1	1	1	1	1	1	1	1	1	1	1
NS	High Limit Well, 3/8" x 2"	13-0104	1	1	1	1	1	1	1	1	1	1	1
	BTC Outdoor Reset Control	14-0305	1	1									
NS	Operator (LB)	14-0007	1	1	1	1	1	1	1	1	1	1	1
	Operator (LW)	14-0010	1	1	1	1	1	1	1	1	1	1	1
	Operator, T6031A (pool heater) (Canada Only)	14-0003	1	1	1	1	1	1	1	1	1	1	1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
45	Firing Valve, 3/4"	11-0461	1	1	1								
	Firing Valve, 1"	11-0456				2	2						
	Firing Valve, 1-1/4"	11-0457						2	2				
	Firing Valve, 1-1/2"	11-0458								2	2	2	
	Firing Valve, 2"	11-0459											2
NS	Manual Pilot "B" Valve	11-0031	1	1	1	1	1	1	1	1	1	1	1
46	Main Gas Valve, VR8304	11-0056	1	1	1								
	Main Gas Valve, V8944B, 1"	11-0171				1	1						
	Main Gas Valve, V8944B, 1-1/4"	11-0172						1	1				
	Main Gas Valve, V8944B, 1-1/2"	11-0173								1	1	1	
	Main Gas Valve, V8944B, 2"	11-0174											1
47	Safety Valve, V48A, 1"	11-0371				1	1						
	Safety Valve, V48A, 1-1/4"	11-0364						1	1				
	Safety Valve, V48A, 1-1/2"	11-0365								1	1	1	
	Safety Valve, V48A, 2"	11-0366											1
48	Pilot Valve, VR8304	11-0056	1	1	1	1	1	1	1	1	1	1	1
	Natural to LP Conversion Spring, On/Off	11-0001	1	1	1	1	1	1	1	1	1	1	1
	Natural to LP Conversion Spring, 2-Stage	11-0007	1	1	1	1	1	1	1	1	1	1	1
49	Manual Shut Off Valve, 1"	11-0465				1	1						
	Manual Shut Off Valve, 1-1/4"	11-0466						1	1				
	Manual Shut Off Valve, 1-1/2"	11-0467								1	1	1	
	Manual Shut Off Valve, 2"	11-0454											1
50	Flame Sensor, UTC 1003 Ignition Module	16-0059	1	1	1	1	1	1	1	1	1	1	1
	BTC Outdoor Reset Control	14-0305	1	1									
NS	Alarm Board, (CSD-1)	16-0023	1	1	1	1	1	1	1	1	1	1	1
51	Spark Generator	16-0036	1	1	1	1	1	1	1	1	1	1	1
52	Transformer, 75 VA	15-0008	1	1	1	1	1	1	1	1	1	1	1
NS	Pressure Relief Valve 50#	30-0360	1	1	1	1	1	1					
	Pressure Relief Valve 50#	13-0006							1	1			
	Pressure Relief Valve 50#	30-0374									1		
	Pressure Relief Valve 50#	30-0379										1	1
	Pressure Relief Valve 125#	13-0009	1	1	1	1	1	1	1	1	1	1	1
NS	Tridicator (LB)	13-0305	1	1	1	1	1	1	1				
	Tridicator (LB)	13-0308								1	1	1	1
	Thermometer (LB)	13-0302	2	2	2	2	2	2	2	1	1	1	1
	Thermometer (LW)	13-0302	2	2	2	2	2	2	2	1	1	1	1
NS	Flow Switch	14-0203	1	1	1	1	1	1	1	1	1	1	1
	Flow Switch (Outdoor)	14-0205	1	1	1	1	1	1	1	1	1	1	1
	Flow Switch (Potter)	14-0201	1	1	1	1	1	1	1	1	1	1	1
	Flow Switch (Outdoor Potter)	14-0202	1	1	1	1	1	1	1	1	1	1	1
NS	Thermometer Well, 3/8 x 3	13-0104	1	1	1								
	Well, 3/8 x 3	13-0105				1	1	1	1	1	1	1	1

REPAIR PARTS *(CONTINUED)*

			Model Size with Item Quantities Below										
Ref #	**Name of Part**	**Part #**	**225**	**300**	**400**	**600**	**750**	**1050**	**1200**	**1480**	**1650**	**1970**	**2300**
54	Main Board Assembly (On/Off)	70-2927	1	1	1	1	1	1	1	1	1	1	1
	Main Board Assembly (2-Stage)	70-2928				1	1	1	1	1	1	1	1
NS	Main Board	40-0074	1	1	1	1	1	1	1	1	1	1	1
NS	Timer Board	40-0075	1	1	1	1	1	1	1	1	1	1	1
NS	LED Indicator Board	40-0076	1	1	1	1	1	1	1	1	1	1	1
NS	Ribbon Cable	44-0057	1	1	1	1	1	1	1	1	1	1	1
NS	Relay, 2P, (On/Off)	15-0121	5	5	5	5	5	5	5	5	5	5	5
NS	Relay, 2P, (2-Stage)	15-0121				8	8	8	8	8	8	8	8
NS	Relay, 3P , (On/Off or 2-Stage)	15-0123	1	1	1	1	1	1	1	1	1	1	1
NS	Relay, 24AC	15-0113	1	1	1	1	1	1	1	1	1	1	1
NS	Pump Contactor 1PH (C2)	15-0118	1	1	1	1	1	1	1	1	1	1	1
NS	Pump Contactor 3PH	15-0111	1	1	1	1	1	1	1	1	1	1	1
NS	Low Gas Pressure Switch (Manual Reset)	11-0410	1	1	1	1	1	1	1	1	1	1	1
NS	High Gas Pressure Switch (Manual Reset)	11-0411	1	1	1	1	1	1	1	1	1	1	1
NS	Terminal Block 7P	48-0153	1	1	1	1	1	1	1	1	1	1	1
NS	Terminal Block 10P	48-0156	1	1	1	1	1	1	1	1	1	1	1
NS	PVC Gasket Foam	66-0103	24	24	28	32	36	40	40	40	48	48	56
NS	Rating Plate	82-0054	1	1	1	1	1	1	1	1	1	1	1
NS	Overlay	82-0188	1	1	1	1	1	1	1	1	1	1	1
NS	Paint	66-0013	1	1	1	1	1	1	1	1	1	1	1
NS	Silicone	66-0151	1	1	1	1	1	1	1	1	1	1	1
NS	Vent Termination Hood 6"	09-0112	1	1	1								
	Vent Termination Hood 7"	09-0140				1							
	Vent Termination Hood 8"	09-0113					1						
	Vent Termination Hood 10"	09-0115						1					
	Vent Termination Hood 12"	09-0116							1	1			
	Vent Termination Hood 14"	09-0141									1	1	1
NS	Air Intake Hood 6"	09-0102	1	1	1								
	Air Intake Hood 8"	09-0103				1	1						
	Air Intake Hood 10"	09-0104						1					
	Air Intake Hood 12"	09-0105							1	1	1	1	1
NS	Barometric Damper 6"	09-0405	1	1	1								
	Barometric Damper 7"	09-0409				1							
	Barometric Damper 8"	09-0404					1						
	Barometric Damper 10"	09-0403						1					
	Barometric Damper 12"	09-0401							1	1			
	Barometric Damper 14"	09-0402									1	1	1
NS	Rack Assembly	70-2886	1	1	1								
		70-2888				1	1						
		70-2890						1					
		70-2892							1	1			
		70-2894									1	1	1

START UP FORM

Date of Start Up: _____ **Job Name:** _____

Model #: _____ **Serial Number #:** _____

Boiler Model: ☐ Dominator ☐ LCD Company Name _____

Fuel Type: ☐ Natural Gas ☐ Propane Tech Name _____

System Type: ☐ Hydronic ☐ Domestic Phone Number _____

PRE-START UP CHECK LIST

☐ ANY VISUAL DAMAGE TO UNIT?
☐ PIPING PROPERLY CONNECTED?
☐ SYSTEM FLOODED AND FLOWING?
☐ BOILER CIRCULATOR WIRED?
☐ VENT/STACK CONNECTED?
☐ IS VENT VERTICAL THROUGH THE ROOF?
☐ IS VENT THROUGH THE WALL?
☐ IS POWER VENT INSTALLED AND WIRED?
☐ SEALED COMBUSTION?
☐ INLET FILTER INSTALLED AND CLEAN?
☐ ALL WIRING CONNECTED PROPERLY?
☐ BOILER PUMP PUMPING INTO INLET?
☐ COMBUSTION AIR PROVIDED?
☐ PROPER SERVICE CLEARANCE PROVIDED?
☐ OUTDOOR AIR SENSOR INSTALLED/WIRED?
☐ ARE UNITS RACKED?
☐ IS RACK ASSEMBLED TIGHTLY?
☐ NO HOLES SCREWED INTO CABINET?

ELECTRICAL/WIRING/CONTROL

_____ Boiler Supply Voltage
_____ Boiler Pump Supply Voltage
_____ Voltage Down Stream of Transformer
_____ External BMS System
_____ Utilize Boiler BTC For Control

BTC CONTROL SET UP: (Not all settings are used for every mode. (Dominator Series Only))

_____ : Mode
_____ : Boiler Target
_____ : Tank Target
_____ : Tank Diff
_____ : Outdoor Start
_____ : Boiler Start
_____ : Boiler Max
_____ : Boiler Min
_____ : Boiler Diff
_____ : Intr-Stg Diff
_____ : Intr-Stg On Dly
_____ : Intr-Stg Off Dly
_____ : Purge ΔT

LCD ONLY
_____ : Operator (STG1)
_____ : High Operator (STG 2)
_____ : High Limit
_____ : Pump Purge

COMBUSTION/SAFETY REPORT

FACTORY FIRE TEST REPORT:	Low Fire	High Fire
Manifold Gas Pressure: "WC"		
Air Differential Pressure: "WC"		

These results are affixed to the side of the heater on a small white label.

FIELD TEST REPORT IN STAGE:	1	2	3	4
Manifold Gas Pressure: "WC"				
Air Differential Pressure: "WC"				
Pilot Manifold Pressure: "WC"				
CO_2:				
Stack Temp. (Net):				
Efficiency @_____°F Inlet Temp.				
CO (PPM):				
O_2:				
Stack Draft (Must Be Negative):				
Pilot Signal:				

SAFETY CONTROL CHECK:	Wired and Operating Properly @ Setting:	Failed To Operate Comment To Right	Comments
Low Water Cut Off (PPM):			
Factory Flow Switch			
Operating Control			
High Limit			
Differential Air Switch STG. 1, 2			
Differential Air Switch STG. 3, 4			
Blocked Flu Switch			
Flame Failure Lockout (CSD-1)			
Pump Delay			
Combustion Air Damper			
Power Vent Proving Switch			
Barometric Damper			

COMMISSIONING THE UNIT

Customer Instructed? ___ Yes ___ No
All Covers Replaced? ___ Yes ___ No
Wiring Secure/Tight? ___ Yes ___ No
Customer Given Manual? ___ Yes ___ No
Cabinet Air Leaks? ___ Yes ___ No
Gas Leaks Detected? ___ Yes ___ No
Unit Cycled Min. of 15 X? ___ Yes ___ No
Temp. Set Per Customer? ___ Yes ___ No
Left Maintenance Instruction? ___ Yes ___ No

The delta T between the heaters inlet and outlet is critical to proper flow. Before you leave the job site you must record the delta T. This reading should not exceed 35°F, *19.4°C* or be lower than 20°F, *11.1°C*.

	Inlet Temperature
	Outlet Temperature

Commissioned By: _____
(Signature)

Date: _____

NOTICE! Commonwealth of Massachusetts Installation Requirements

MACODE-3

NOTICE In the Commonwealth of Massachusetts, the installation must be performed by a licensed plumber or gas fitter.

1. For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade, in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

   d. INSTALLATION OF CARBON MONOXIDE DETECTORS. At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

      i. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

      ii. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

   e. APPROVED CARBON MONOXIDE DETECTORS. Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

   f. SIGNAGE. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".

   g. INSPECTION. The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

WARNING Improper venting can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

2. Exemptions — The following equipment is exempt from 248 CMR 5.08(2)(a) 1 through 4:

   a. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and

   b. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

3. MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.

   a. When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

      i. Detailed instructions for the installation of the venting system design or the venting system components; and

      ii. A complete parts list for the venting system design or venting system.

4. MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.

   a. When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

      i. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and

      ii. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

5. A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

WARNING Improper venting can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

LIMITED WARRANTY

Boilers/Water Heaters
Industrial, Commercial and Other Non-Residential Use

The "Manufacturer" warrants to the original owner at the original installation site that the heat exchanger of the Industrial, Commercial, and other Non-Residential Use Boiler (the "Product") will be free from defects in material or workmanship for ten (10) years from the date of installation. Additional twenty one (21) year thermal shock warranty on heat exchanger. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the Manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective. All other RBI supplied Boiler/Water Heater parts are warranted against defects in material and workmanship for one (1) year from date of installation or 18 months from date of shipment from RBI.

The "Manufacturer" warrants to the original owner at the original installation site that the heat exchanger of the Industrial, Commercial, and other Non-Residential Use Water Heater (the "Product") will be free from defects in material or workmanship for five (5) years from the date of installation. Additional twenty one (21) year thermal warranty on heat exchanger. If upon examination by the Manufacturer the Product is shown to have a defect in material or workmanship during the warranty period, the Manufacturer will repair or replace, at its option, that part of the Product which is shown to be defective. All other RBI supplied Boiler/Water Heater parts are warranted against defects in material and workmanship for one (1) year from date of installation or 18 months from date of shipment from RBI.

This limited warranty does not apply:

(a) if the Product has been subjected to misuse or neglect, has been accidentally or intentionally damaged, has not been installed, maintained or operated in accordance with the furnished written instructions, or has been altered or modified in any way.
These include but not limited to:
- Excessive water hardness causing a lime build-up in the heat exchanger tubes is not a fault of the equipment and is not covered under the manufacturer's warranty.
- Excessive pitting and erosion on the inside of the heat exchanger tubes caused by high water velocity through the tubes and is not covered by the manufacturer's warranty. (See Installation Instructions for proper pump performance.)
- Chemical corrosion, no corrosive chemical (freon, dry cleaning chemicals, degreasing liquids, chlorine or any chemicals that produce hydrochloric acid) can be present in the boiler room as it rapidly destroys the heating equipment and voids the warranty.
- All copper fin boilers should not operate with a return water temperature less than 110°F, 43°C atmospheric combustion, 125°F, 52°C fan assist combustion. If a lower temperature is required, an external bypass should be installed to prevent condensation. The manufacturer's warranty does not cover damage done by condensation.

(b) to any expenses, including labor or material, incurred during removal or reinstallation of the Product or parts thereof.

(c) to damage as a result of settlement, distortion, collapse, or cracking of any foundation area, beams or pipes surrounding the Product.

(d) to any workmanship of any installer of the Product; or to Products installed outside the continental United States or Canada.

This limited warranty is conditional upon:

(a) shipment, to the Manufacturer, of that part of the Product thought to be defective. Goods can only be returned with prior written approval from the Manufacturer. All returns must be freight prepaid.

(b) determination in the reasonable opinion of the Manufacturer that there exists a defect in material or workmanship.

Repair or replacement of any part under this Limited Warranty shall not extend the duration of the warranty with respect to such repaired or replaced part beyond the stated warranty period.

THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ALL SUCH OTHER WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS LIMITED WARRANTY. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE IN ANY WAY FOR ANY CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER, OR FOR ANY AMOUNTS IN EXCESS OF THE SELLING PRICE OF THE PRODUCT OR ANY PARTS THEREOF FOUND TO BE DEFECTIVE. THIS LIMITED WARRANTY GIVES THE ORIGINAL OWNER OF THE PRODUCT SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY BY EACH JURISDICTION.

RBI®

260 North Elm Street
Westfield, MA 01085
Phone: (413) 568-9571
Fax: (413) 568-9613

7555 Tranmere Drive
Mississauga, Ontario L5S 1L4 Canada
Phone: (905) 670-5888
Fax: (905) 670-5782

www.rbiwaterheaters.com

A MESTEK COMPANY

260 North Elm Street
Westfield, MA 01085
Phone: (413) 568-9571
Fax: (413) 568-9613

7555 Tranmere Drive
Mississauga, Ontario L5S 1L4 Canada
Phone: (905) 670-5888
Fax: (905) 670-5782

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